ANNEXES

ANNEX A: COMPONENT DATASHEET

1 Force system

1.1 APA1000L Piezoelectric actuato

1.2 CA 45 Compact stand alone amplifier

1.3 U9B Load cell

2 Heating system

2.1 SITOP flexi Power supply

2.2 MSH Ceramic infrared radiators

3 Vacuum system

3.1 HiCube Eco Turbopump

3.2 PKR 251 Compact fullrange gauge

3.3 RS 428-477 Power supply

4 National Instruments equipment

4.1 NI cDAQ-9174 USB chassis

4.2 NI 9219 Universal measurement device

4.3 NI 9263 Analog output

4.4 NI 9211 Thermocouple input

5 Image acquisition

5.1 BASLER acA2500-um Camera

5.2 Edmund Optics 63743 Telecentric lens

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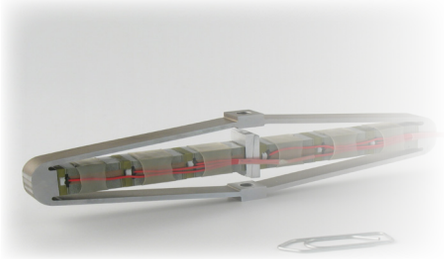

NON CONTRACTUAL PICTURE

TABLE OF STANDARD PROPERTIES OF USE AND MEASUREMENT

The properties defined in the table below, are set up according to the technical conditions of use and measurement. These properties are warranted within their variation range and in compliance with the standard technical conditions of use.

PROPERTIES	STANDARD TECHNICAL CONDITIONS	UNIT	NOMINAL VALUES	MIN. VALUES	MAX. VALUES
Notes		-	-	-	-
Max. no load displacement	Quasistatic excitation, blocked-free	µm	897	717	1058
Blocked force	Quasistatic excitation, blocked-free	N	292.3	248.4	336.1
Stiffness	Quasistatic excitation, blocked-free	N/µm	0.326	0.261	0.36
Resonance frequency (free-free)	Harmonic excitation, free-free, on the admittance curve	Hz	1305	1109	1436
Response time (free-free)		ms	0.38	0.34	0.44
Resonance frequency (blocked-free)	Harmonic excitation, blocked-free, on the admittance curve	Hz	254	216	279
Response time (blocked-free)		ms	1.97	1.77	2.26
Capacitance	Quasistatic excitation, free-free, on the admittance curve	µF	40.00	36.00	52.00
Max. no load displacement at resonance	Max. harmonic excitation, free-free	µm p-p	404	323	484
Max. voltage at resonance	Max. harmonic excitation, free-free	Vrms	9.00	7.20	10.80
Force limit (0-pk)	Max. harmonic excitation, free-free	N	73.07	58.46	80.38
Resolution	Quasistatic excitation	nm	9	-	-
Height (in actuation direction)		mm	35.00	34.90	35.10
Length		mm	145.00	144.90	145.10
Width (excl. wedge & wires)		mm	10.00	9.95	10.05
Width (incl. wedge & wires)		mm	16.00	15.00	17.50
Mass		g	190.0	-	-
Standard mechanical interface	2 flat surfaces 1*2.5 mm² with a Ø 0.8 mm hole	-	-	-	-
Standard electrical interface	2 single Cu wires 80 mm long with Ø 1 banana plug	-	-	-	-

PROPERTIES STANDARD TECHNICAL CONDITIONS OF USE AND MEASUREMENT

Free-free :	The actuator is not fixed
Blocked-free :	The actuator is fixed to a mechanical support assumed infinitely stiff
Quasistatic excitation :	AC voltage between –20 and 150 V at 1 Hz
Harmonic excitation :	Voltage of 0.5 Vrms, sinusoidal mode from 0 to 100 kHz
Max. harmonic excitation :	Voltage defined by the measurement of max. displacement, sinus at resonance frequency
Displacement measurement :	Laser interferometer, capacitive displacement sensor
Admittance measurement :	HP 4194 A or Cypher C60 electrical impedance analyser
Environment :	Ambient temperature (15-25°C) and dry air (Humidity < 50 % rH)

Any technical conditions of use, different from those defined above, can lead to temporary or definitive alterations of properties. Thank you to contact CEDRAT TECHNOLOGIES before using actuators under non standard technical conditions.

FACTORY TESTS CARRIED OUT

- ☑ Test 1 : Electrical admittance vs. Frequency, free-free
- ☑ Test 2 : Displacement vs. input voltage

OPTIONAL EXTRA FACTORY TESTS

- ☑ Test 3 : Gain and linearity of the sensor
- ☑ Test 4 : Step response in closed loop
- ☑ Test 5 : Stability in closed loop

OPTIONAL MECHANICAL INTERFACE

- ☑ [FI] Flat Interface
- ☑ [FF] Free-free Interface
- ☑ [H] Flat Interface with hole
- ☑ [SI] Specific interface
- ☑ [TH] Flat Interface with threaded hole

AVAILABLE OPTIONS

- ☑ [SG] Strain gauges
- ☑ [NM] Non-magnetic
- ☐ [ECS] Eddy current displacement sensor
- ☑ [VAC] Vacuum
- ☑ [SV] Specific version / Customization

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2D CONFIGURATION

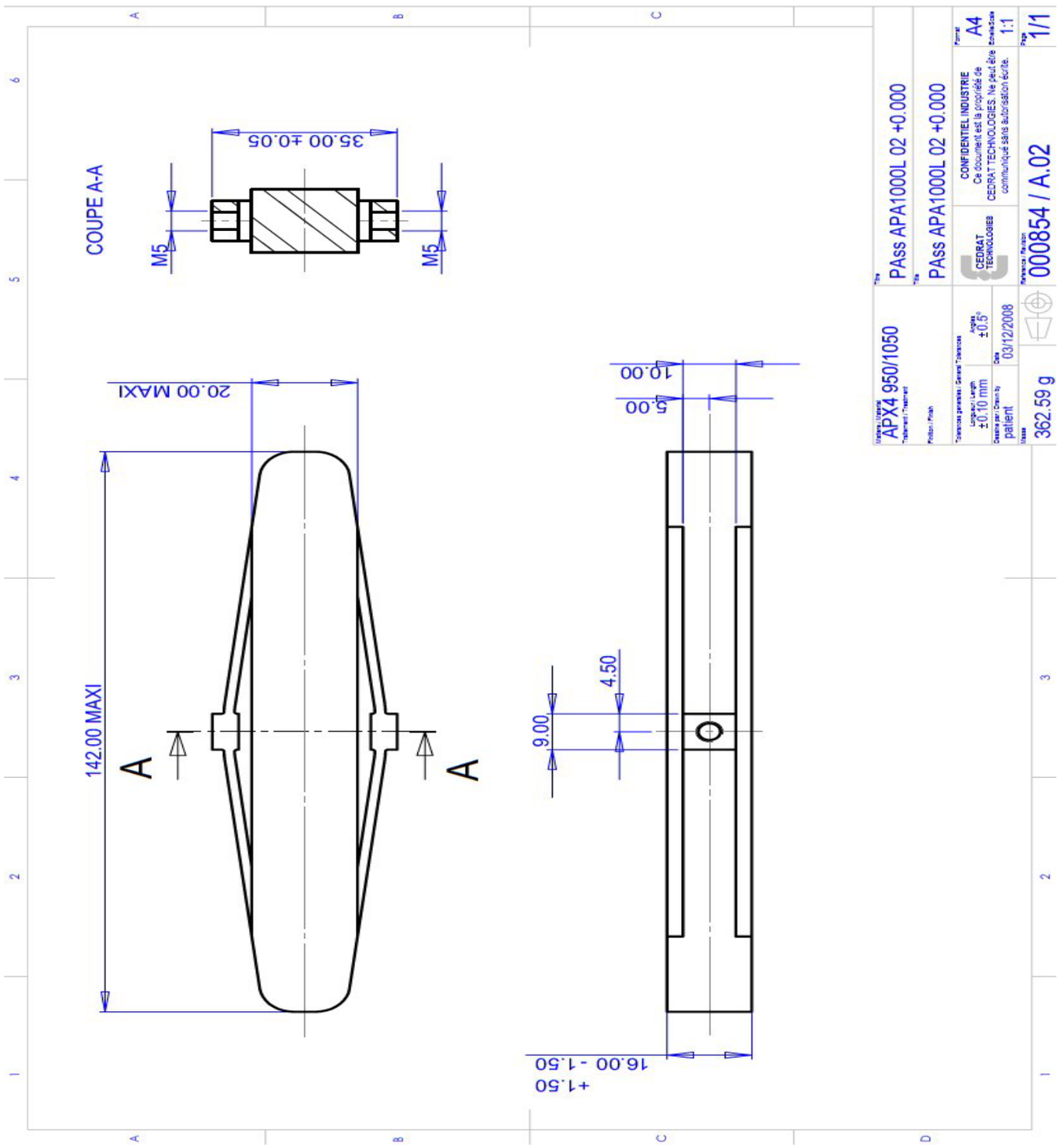

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TABLE OF STANDARD PROPERTIES OF USE AND MEASUREMENT

The properties defined in the table below, are set up according to the technical conditions of use and measurement. These properties are warranted within their variation range and in compliance with the standard technical conditions of use.

Properties CA45	Standard technical conditions	Unit	Nominal values	Min. values	Max. values
Notes			-		
Function			*Standalone voltage amplifier*		
Cooling			*Natural convection*		
Protection			*Thermal Overcurrent Overvoltage*		
Main voltage	*Standard main supply*	*VAC*	*230*	*190.0*	*250.0*
Main frequency	*Standard main supply*	*Hz*	*50*	*45.0*	*65.0*
Min. input voltage	*Standard environment*	*V*	*-1.2*	*-1.5*	*-1.2*
Max. input voltage	*Standard environment*	*V*	*7,7*	*7.7*	*7.9*
Min. output voltage	*Standard environment*	*V*	*-20*	*-19.0*	*-22.0*
Max. output voltage	*Standard environment*	*V*	*150*	*145.0*	*160.0*
Gain	*Standard environment*	*V/V*	*20*	*19.0*	*21.0*
Max. output current		*A*	*0.036*	*0.027*	*0.045*
Max. output load capacitance		*µF*	*400*	*360.0*	*440.0*
Signal to noise ratio	*Noise measurement conditions*	*dB*	*85*	*80.0*	*90.0*
Unloaded output bandwith (-3dB)		*Hz*	*30000*	*27000*	*33000*
Loaded Output bandwidth (-3dB)	*Standard load*	*Hz*	*62*	*61.6*	*67.8*
Input impedance		*kOhms*	*10*	*9.5*	*10.5*
Mass		*g*	*1200*	*-*	*-*
Dimensions		*mm*	*12F wide, 3H high*		

Option UC45	Standard technical conditions	Unit	Nominal values	Min. values	Max. values
Notes					
Function			*Option on amplifier board - Numerical servo controller*		
Size		*mm*	*50*70*		
Max. number of control channels			*1 per channel*		
Sampling frequency		*Hz*	*10000*		
A/D converters			*16 bit @ +/-10V*		
D/A converters			*16 bit @ +/-10V*		
Computer interface			*USB*		
Optional link			*SPI*		
Corrector filter cells	*2nd order low-pass or stop-band filter @ [150 2000]Hz*		*Selectable by the GUI HDPM45*		

**Bandwidth settled according to your specifications; by default 1 Hz.*

TECHNICAL DATA SHEET | CA45 | v3.3

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Option SG	Standard technical conditions	Unit	Nominal values	Min. values	Max. values
Notes			*Option on amplifier board*		
Function			*Strain Gauges conditioner*		
Signal to noise ratio	*Noise measurement conditions*	*dB*	*85*	*80*	*90*
*Output bandwidth**		*Hz*	*2000*	*1800*	*2200*
Accuracy (closed loop)		*%*	*0.1*	*0.07*	*0.13*

➢ PROPERTIES STANDARD TECHNICAL CONDITIONS OF USE AND MEASUREMENT

Quasistatic excitation : AC voltage between –20 and 150 V at 1 Hz
Environment : Ambient temperature (15-25°C) and dry air (Humidity < 50 % rH)
Standard main supply : Main according to directive HD472; could be adapted to 110 VAC on request
Noise measurement conditions : Excitation 0.5 Vrms ; reading bandwidth 1 Hz to 1 kHz
Standard load : Actuator APA from series S or SM : 1.55 µF (load test may be different)

Any technical conditions of use, different from those defined above, can lead to temporary or definitive alterations of properties. Thank you to contact CEDRAT TECHNOLOGIES before using actuators under non standard technical conditions.

➢ FACTORY TESTS CARRIED OUT

☒ Test 1: Load and discharge time
☒ Test 2: Linearity output voltage vs. input voltage

➢ EXTRA FACTORY TESTS

☐ Test 3: Gain and linearity in closed loop
☐ Test 4: Step response in closed loop (sensor output voltage versus command voltage
☐ Test 5: Bode diagram

➢ AVAILABLE OPTIONS

☒ [UC] Servo controller ☐ [PP] Push-pull ☒ [SG] Strain Gauges conditionner

Data Sheet

U9B

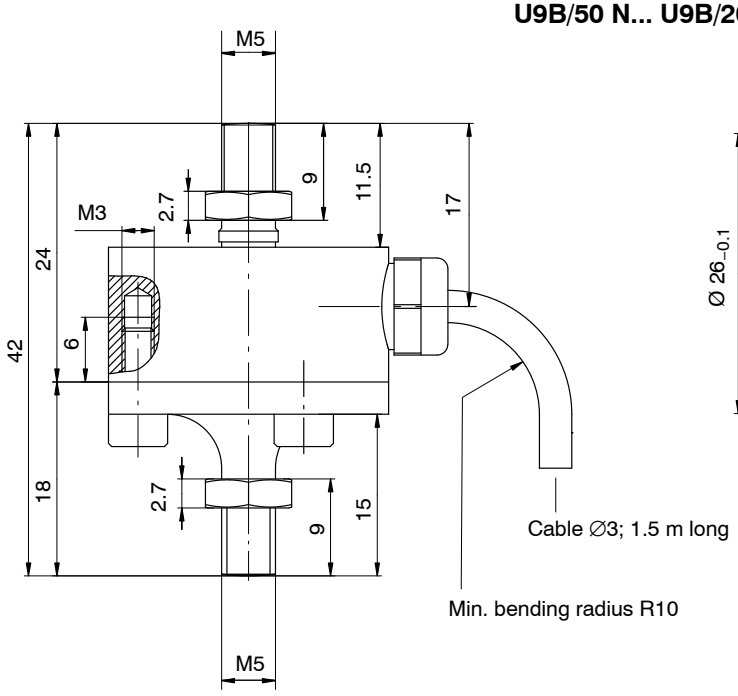
Force Transducers

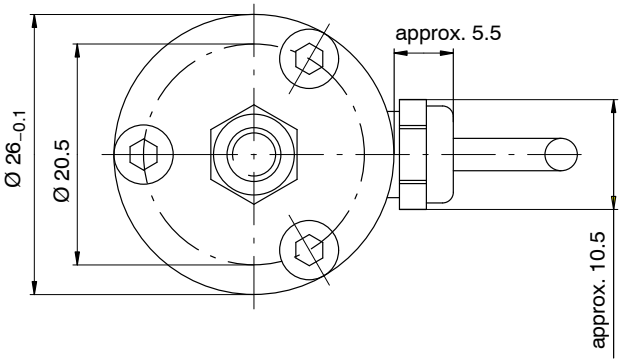
Special features

- **Tensile / compressive force transducer in non-rusting material**
- **Nominal (rated) forces 50 N ... 50 kN**
- **Small size**
- **Accuracy class 0.5**
- **Maintenance-free knuckle eye as force-introduction aid**

Dimensions (in mm; 1 mm= 0.03937 inches)

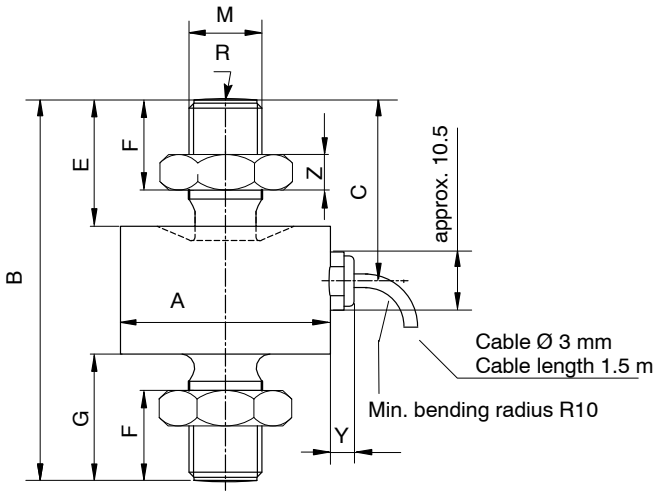
U9B/50 N... U9B/200 N



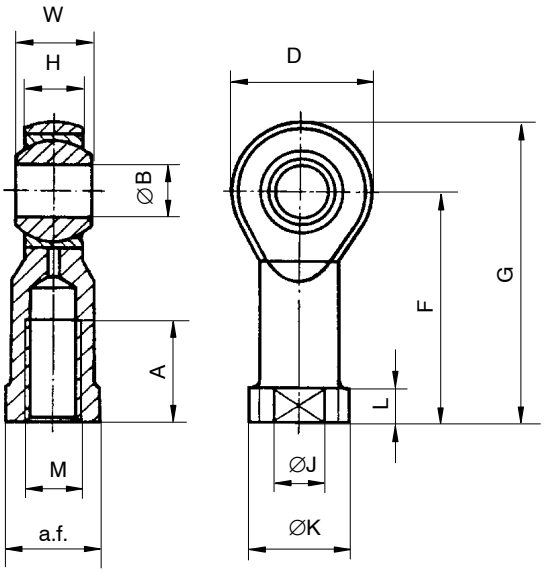


Bottom view

U9B/0.5 kN ... U9B/50 kN



Knuckle eye ZGW



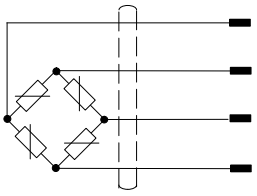
All dimensions in mm

Nominal (rated) force U9B	$A_{-0.1}$	B	C	E	F	G	M	R	Y	Z
0.5...1 kN	26	44.5	20.5	13	9.5	13.5	M5	20	approx. 5.5	2.7
2...20 kN	26	60	28.5	21	16	21	M10	40	approx. 5.5	5
50 kN	46	84	40	28	21.5	28	M16x1.5	80	approx. 5.5	8

Knuckle eye:

Nominal (rated) force ZGW	A	B	D	F	G	H	J	K	L	M	a.f.	W
50 N...1 kN	10	5^{H7}	18	27	36	6	9	11	4	M5	9	8
2...20 kN	20	10^{H7}	28	43	57	10.5	15	19	6.5	M10	17	14
50 kN	28	16^{H7}	42	64	85	15	22	27	8	M16x1.5	22	21

Cable assignment (Four wire-circuit)



WH (white)	Measuring signal (+) U_A
BK (black)	Excitation voltage (–) U_B
RD (red)	Measuring signal (–) U_A
BU (blue)	Excitation voltage (+) U_B

Cable shielding, connected with housing

Specifications

Type			U9B								
Nominal (rated) force	F_{nom}	N	50	100	200						
		kN				0.5	1	2	5	10	20	50
Accuracy class			0.5								
Nominal (rated) sensitivity	C_{nom}	mV/V	1								
Rel. sensitivity deviation	d_c	%	≤ ±1 tension / ≤ ±2 compression								
Temperature effect on the sensitivity per 10 K	TK_C										
in the nominal (rated) temperature range		%	≤ ±0.5								
in the operating temperature range		%	≤ ±0.8								
Temperature effect on the zero signal per 10 K	TK_0										
in the nominal (rated) temperature range		%	≤ ±0.5								
in the operating temperature range		%	≤ ±0.8								
Zero signal tolerance	$d_{s,o}$	mV/V	± 0.075			±0.2					
Linearity	d_{lin}	%	≤ ±0.5								
Rel. reversibility error	U	%	≤ ±0.5								
Rel. repeatability error without rotation	brg	%	≤ ±0.5								
Creep, over 30 min	d_{crF+E}	%	≤ ±0.2								
Input resistance	R_e	Ω	>345			300–400					
Output resistance	R_a	Ω	300–400			<350					
Insulation resistance	R_{Is}	GΩ	> 1 x10^9								
Operating range of supply voltage	$B_{U,G}$	V	0.5...12								
Reference supply voltage	U_{ref}	V	5								
Reference temperature	t_{ref}	°C [°F]	+ 23 [+73.4]								
Nominal (rated) temperature range	$B_{t,nom}$	°C [°F]	–10...+70 [+14...+158]								
Operating temperature range	$B_{t,G}$	°C [°F]	–30...+85 [–22...+185]								
Storage temperature range	$B_{t,S}$	°C [°F]	–30...+85 [–58...+185]								
Protection to DIN EN 60 529			IP 67								
Nominal (rated) measuring displacement ±15 %	S_{nom}	mm	< 0.1				0.04		0.06	0.09	0.11	0.13
Natural frequency ±15 %		kHz	7.3	10	15.7	15.5	23.7	18.7	20	23	27.8	20
Working force	(F_G)	%	120									
Breaking force	(F_B)	%	>200									
Relative static lateral limit force [1]	(F_Q)	%	40					20				
Permissible vibration amplitude to DIN 50 100	Frb	%	70									40
Weight, approx.		g	75			100						400
Cable length		m	1.5									

[1] referred to the 2 mm force introduction point above diaphragm

Order numbers:
Force transducer

Order code	Nominal (rated) force										Unit
1–U9B/ ...	50	100	200								N
				0,5	1	2	5	10	20	50	kN

Ordering numbers: 1–U9B/2kN

Accessories (to be ordered separately)

1–Z8/100kg/ZGW	Knuckle eye 50 N ... 1 kN
1–U9/20kN/ZGWR	Knuckle eye 2 kN ... 20 kN
1–U9A/50kN/ZGW	Knuckle eye 50 kN
D–15D/MONT	15pin D-connector, mounted to transducer cable
D–MS/MONT	MS3106PEMV-connector, mounted to transducer cable

Bild 55: Elstein MSH/20 micro system radiator

Elstein MSH micro system heaters are ceramic infrared radiators in small design. They reach operating temperatures up to 860 °C and surface ratings up to 100 kW/m².

MSH micro system heaters are used in applications, which require partial heating or drying of small goods and areas. This occurs for example at heating of printed circuit boards.

MSH radiators are suitable both for individual operation and for configuring groups of radiators to an infrared heating panel.

In this way small heating panels can be built, which can be adapted to the requirements of the heating task or the size as well as contours of the material to be heated regarding heated area, dimensions and the acuteness or the heating zones.

Elstein MSH micro system heaters are available with a power of 55 W 12 V.

MSH/20

Mounting hole: 9 x 21

The mounting hole is a cutout in the metal mounting sheet or the reflector to place the radiator there.

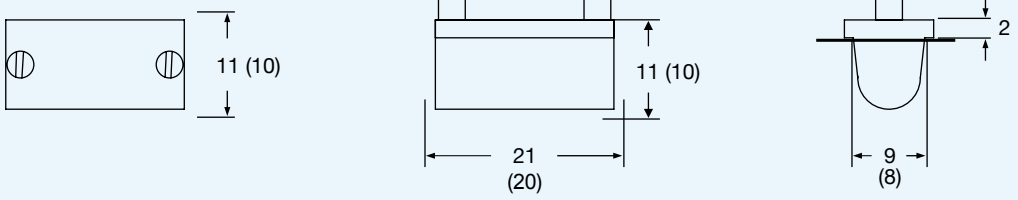


Figure 56: Mounting dimensions and radiator dimensions ( ) in mm

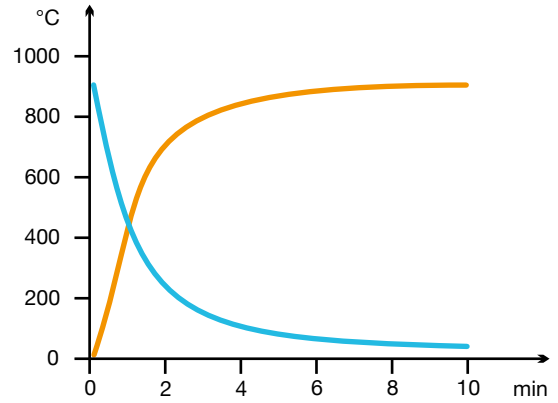


Fig. 57: Radiator temperatures
Heating-up: red curve
Cooling-down: blue curve

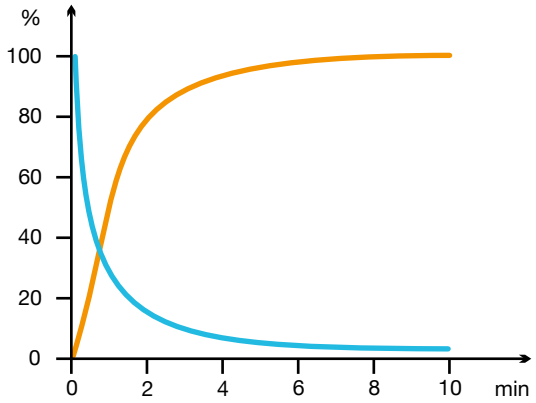


Fig. 58: Radiant powers
Heating-up: red curve
Cooling-down: blue curve

Type, weight, wattage MSH/20 3 g	55	W
Surface rating	100	kW/m²
Typical operating temperature	860	°C
Maximum permissible temperature	900	°C
Wavelength range	2 - 10	µm

Standard design

Operating voltage 12 V
Ceramic full-pour casting
Black glaze
Leads 30 mm

Optional accessory
THI Thermal insulation sheet
50 x 50 x 12 mm

Thermocouple radiators

Designation T-MSH/20
Integrated thermocouple
Type K (NiCr-Ni)
TC leads 53 mm

Variants

Special wattages
Special voltages
Extended leads
Leads with ring terminals

The power can be controlled using thermocouple radiators together with TRD 1 temperature controllers, TSE thyristor switching units and other accessories.

The national safety regulations must be complied with for the respective application, for example, the IEC or EN standard 60519-1, Safety in electrical heating installations.

Our instructions for mounting, operation and safety must be observed.

The flexible power supply for a wide variety of applications

Technical Description · March 2008

Maximum flexibility is required when supplying power to a variety of applications: it can be 5 V one time, then 15 V and then possibly 46.5 V DC. For these applications, SITOP flexi is the smart solution.
With this universal power supply unit, you can easily set output voltages between 3 V and 57 V DC. All you need is this standard product – no need to waste time and money purchasing a whole range of different units. Save shipping and servicing costs too! Many additional features make applications possible that other conventional supplies just cannot match. Quite flexible, isn't it?

All advantages at a glance

- Output continuously adjustable from 3 V to 57 V DC
- Dynamic adjustment of the output voltage also possible via analog input signal
- Many possible applications, e.g. motor speed control or test rig supply
- One universal supply can simplify configuring, servicing and spares backup, available from stock
- Remote diagnostics through floating relay contact as "Power Good" signal
- Load monitoring via integrated current monitor: output current value as analog signal
- Precise voltage at load thanks to remote sensing
- Constant current characteristic in case of overload ensures the start-up
- Standard DIN Rail mounting

SITOP flexi

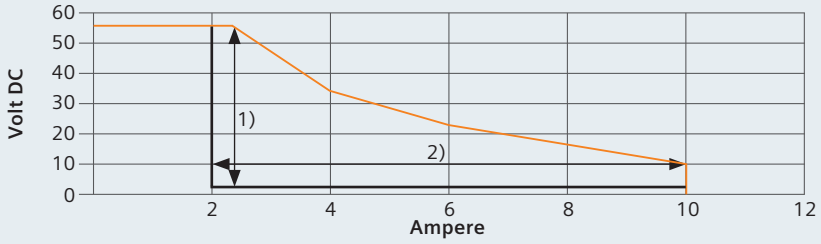
Answers for Industry.

SIEMENS

Technical specifications

SITOP flexi		
Input data	Input voltage – Rated input voltage – Range	 Single-phase AC voltage 120 / 230 V AC, adjustable using wire jumper 85 to 132/170 to 264 V AC
	Hold-up time	> 10 ms 93 / 187 V and 120 W
	Mains frequency – Rated frequency – Range	 50/60 Hz 47 to 63 Hz
	Input current – Rated value – Inrush current (+25 °C) – I^2t – Integral input fuse – Recommended primary side protection	 2.2/0.9 A < 32 A 0.8 A^2s T 3.15 A (not accessible) 6 A characteristic C
Output data	Output voltage – Range of adjustment	 Stabilized, floating DC voltage 3 ... 57 V DC, adjustable using potentiometer or remote-controlled via analog control voltage signal 0...2.5 V DC
	– Steady-state voltage tolerance – Residual ripple – Switching transients Output current, output power	1% < 50 mVpp < 100 mVpp Current limiting in range 3 to 12 V DC and power limiting in range 12 to 57 V DC
	– Max. output current (in range 3 to 12 V DC) – Max. output power (in range 12 to 57 V DC) – Current limiting	10 A 125 W 2 ... 10 A, adjustable using potentiometer or remote-controlled via analog control voltage signal 0 ... 2.5 V DC
	Efficiency at $U_{I\,rated}$ and 24 V DC/5 A output Parallel connection possible Electronic short-circuit protection Additional functions	Approx. 84% Yes Yes, constant current Sense line connection, power good signal (relay contact), current monitor
RFI Specification	RI suppression (EN 55022)	Class B
Standards	Protection class Electrical isolation (SELV to EN 60950) Degree of protection (EN 60529) IP20 Certification	Class I Yes IP20 CE, cULus-Listed (UL 508, CSAC22.2 No.142) File E143289
General data	Ambient temperature Storage and transport temperature Connections (solid or finely stranded conductors) – Connections for inputs L1, N, PE 1 – Connections for output L + – Connections for output M Dimensions W x H x D in mm (in) Approx. weight kg (lbs)	0 to +60 °C –25 to +85 °C 1 x 0.5 to 2.5 mm^2 (20 AWG – 12 AWG) each 1 x 0.5 to 2.5 mm^2 (20 AWG – 12 AWG) 2 x 0.5 to 2.5 mm^2 (20 AWG – 12 AWG) 75 x 125 x 125 (2.95 x 4.92 x 4.92) 0.9 (2)
Ordering data	Order No.	6EP1353-2BA00

Output characteristic



1) Range of adjustment for output voltage

2) Range of adjustment for current limiting

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HiCube™ Eco

Complete Dry Turbo Station from the Most Reliable Turbopump Manufacturer

- Plug and play pumping station
- Compact and economical
- Dry high-vacuum system with turbo and diaphragm pump
- Flexible design
- Versatile accessories
- Display control unit with integrated gauge connection

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Bench top air-cooled* turbo pumping station
with dry diaphragm vacuum pump.
For all applications in the high-vacuum.

Simply plug and play!

Applications

- Laboratory applications
- Spectroscopy
- Surface analysis
- Small coating systems
- Leak detection
- Tube manufacturing

Technical data

Economy pumping station		
Flange (in)	DN 40 ISO-KF	DN 63 ISO-K/CF-F
Mains requirement:		
Power consumption	230 VA	
Voltage (range)	110 V, 50/60 Hz; 230 V, 50/60 Hz	
Pumping speed for N_2	35 l/s	67 l/s
Pumping speed backing pump at 50 Hz	0.9 m^3/h	
Pumping station components	HiPace 80, MVP 015-2, TPS 110, DCU 002	
Ultimate pressure	$< 1 \cdot 10^{-7}$ mbar	
Weight	17 kg	

* Available with water cooling as well

Order numbers

HiCube	Order number
HiCube 80 Eco, DN 63 ISO-K, with DCU 002**	**PM S03 555**
HiCube 80 Eco, DN 63 CF-F, with DCU 002**	**PM S03 556**
HiCube 80 Eco, DN 40 ISO-KF, with DCU 002**	**PM S03 557**
HiCube 80 Eco, DN 63 ISO-K, without DCU 002	**PM S03 550**
HiCube 80 Eco, DN 63 CF-F, without DCU 002	**PM S03 551**
HiCube 80 Eco, DN 40 ISO-KF, without DCU 002	**PM S03 552**

** DCU 002 – Display control unit.
Enables easiest operation and connection of gauges

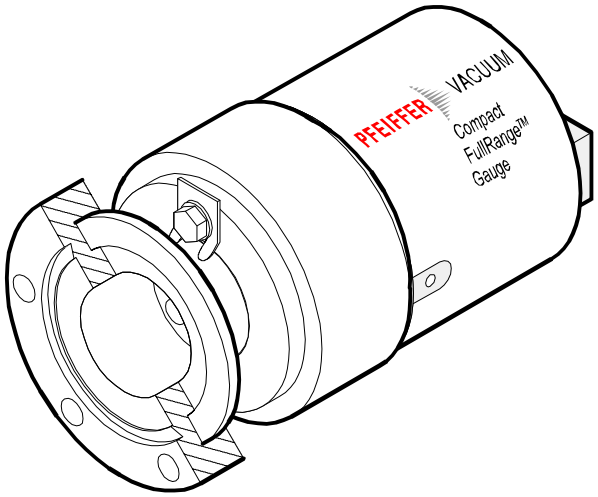
All data subject to change without prior notice. PT 0131 PE (December 2008/10)

PFEIFFER VACUUM

Compact FullRange™ Gauge

FPM sealed

PKR 251



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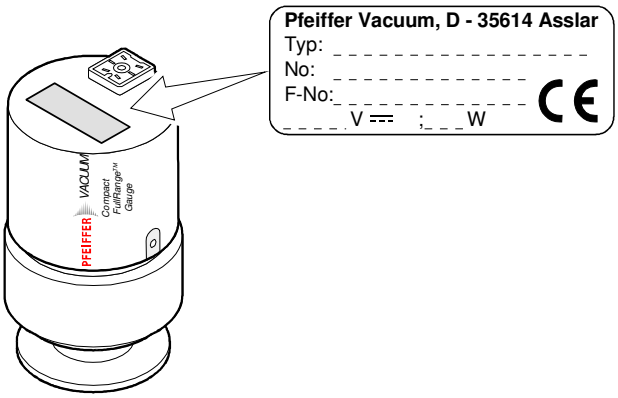
For cross references within this document, the symbol (→ 🗎 XY) is used, for references to other documents, the symbol (→ 🕮 [Z]).

Product Identification

In all communications with Pfeiffer Vacuum, please specify the information given on the product nameplate.



Validity

This document applies to products with part number

PTR26000	(DN 25 ISO-KF flange)
PTR26001	(DN 40 ISO-KF flange)
PTR26002	(DN 40 CF-F flange)

The part number can be taken from the product nameplate.

We reserve the right to make technical changes without prior notice.

Intended Use

The PKR 251 Compact FullRange™ Gauge has been designed for vacuum measurement in the pressure range of 5×10^{-9} … 1000 mbar.

The PKR 251 can be used with a Pfeiffer Vacuum measurement unit for Compact Gauges or with another evaluation unit.

Functional Principle

Over the whole measurement range, the measuring signal is output as a logarithm of the pressure.

The PKR 251 gauge consists of two separate measurement systems (the Pirani and the cold cathode system according to the inverted magnetron principle). They are combined in such a way that for the user, they behave as one single measurement system.

1 Safety

1.1 Symbols Used

DANGER

Information on preventing any kind of physical injury.

WARNING

Information on preventing extensive equipment and environmental damage.

Caution

Information on correct handling or use. Disregard can lead to malfunctions or minor equipment damage.

1.2 Personnel Qualifications

Skilled personnel

All work described in this document may only be carried out by persons who have suitable technical training and the necessary experience or who have been instructed by the custodian of the product.

1.3 Safety Information

- Adhere to the applicable regulations and take the necessary precautions for the process media used.

  Consider possible reactions between the materials (→ 🗎 7) and the process media.

  Consider possible reactions of the process media due to the heat generated by the product.
- Adhere to the applicable regulations and take the necessary precautions for all work you are going to do and consider the safety information in this document.
- Before you begin to work, find out whether any vacuum components are contaminated. Adhere to the relevant regulations and take the necessary precautions when handling contaminated parts.

Pass on the safety information to other users.

1.4 Liability and Warranty

Pfeiffer Vacuum assumes no liability and the warranty becomes null and void if the custodian or third parties

- disregard the information in this document
- use the product in a non-conforming manner
- make any kind of changes (modifications, alterations etc.) to the product
- use the product with accessories not listed in the corresponding product documentation.

The custodian assumes the responsibility in conjunction with the process media used.

2 Technical Data

Admissible temperatures	
Storage	-40 °C … +65 °C
Operation	+ 5 °C … +55 °C
Bakeout	+150 °C (without electronics unit and magnetic shielding)
Relative humidity	max. 80% at temperatures ≤+31 °C decreasing to 50% at +40 °C
Use	indoors only altitude up to 2000 m (6600 ft)

Measurement range (air, N_2)	5×10^{-9} … 1000 mbar
Accuracy	≈±30% in the range 1×10^{-8} … 100 mbar
Reproducibility	≈±5% in the range 1×10^{-8} … 100 mbar
Gas type dependence	→ Appendix B

Adjustment	(→ 🗎 14)
Pirani measurement circuit	
<HV> trimmer potentiometer	at $<1\times10^{-4}$ mbar (while depressing the pin)
<ATM> trimmer potentiometer	at atmospheric pressure
Cold cathode measurement circuit	no adjustment (the gauge is adjusted at the factory and requires no maintenance)

Type of protection	IP 40
Maximum pressure (absolute)	10 bar only for inert gases <55 °C

Supply

DANGER

The gauge may only be connected to supply or measurement units that conform to the requirements of a grounded protective extra-low voltage (SELV-E according to EN 61010). The connection to the gauge has to be fused.[1)]

Voltage at the gauge	15.0 … 30.0 VDC (max. ripple 1 V_{pp})
Power consumption	≤2 W
Fuse[1)]	≤1 AT

The minimum voltage of the power supply must be increased proportionally to the length of the measuring cable.

Voltage at the supply unit with maximum cable length	16.0 … 30.0 VDC (max. ripple 1 V_{pp})

Electrical connection	Hirschmann compact connector type GO 6, 6 pins, male
Cable	5 poles plus screening
Maximum cable length	75 m (0.25 mm² conductor) 100 m (0.34 mm² conductor) 300 m (1.0 mm² conductor)

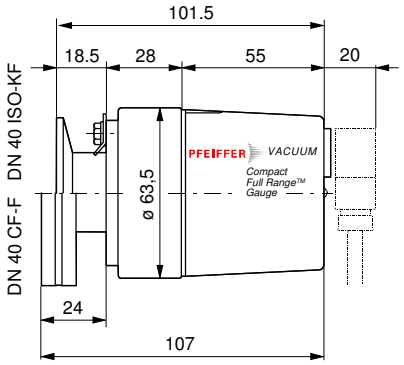
1) Pfeiffer Vacuum measurement and control units for Compact Gauges fulfill these requirements.

Operating voltage (in the measuring chamber)	≤3.3 kV
Operating current (in the measuring chamber)	≤500 µA
Output signal (measuring signal)	
Voltage range	≈0 V … ≈+10.5 V
Relationship voltage-pressure	logarithmic, increase 0.6 V / decade (→ Appendix A)
Error signals	<0.5 V (no supply) >9.5 V (Pirani measurement element defective; filament rupture)
Output impedance	2×10 Ω
Minimum load	10 kΩ, short-circuit proof
Response time	pressure dependent
$p > 10^{-6}$ mbar	≈10 ms
$p = 10^{-8}$ mbar	≈1 s
Gauge identification	→ Figure 1
Pirani-only mode	11.1 kΩ resistor referenced to supply common
Combined Pirani / cold cathode mode	9.1 kΩ resistor referenced to supply common
The following conditions must be fulfilled:	
Polarity	The polarity of pin 1 referenced to supply common is always positive.
Measurement	
with constant current	measurement current within range 0.2 … 0.3 mA
with constant voltage	measurement voltage within range 2 … 3 V
Grounding concept	→ Figure 1
Vacuum flange-measurement common	connected via 10 kΩ (max. voltage differential with respect to safety ±50 V with respect to accuracy ±10 V)
Supply common-signal common	conducted separately; differential measurement recommended for cable lengths ≥6 m

PTR26000 (DN 25 ISO-KF)

Materials exposed to the vacuum	
Flange	stainless steel (1.4104)
Measuring chamber	stainless steel (1.4104)
Feedthrough isolation	ceramic (Al_2O_3), glass
Internal seals	FPM75
Anode	Mo
Ignition aid	stainless steel (1.4310/AISI 301)
Pirani measuring tube	Ni, Au
Pirani filament	W
Internal volume	≈ 20 cm³

Dimensions [mm]

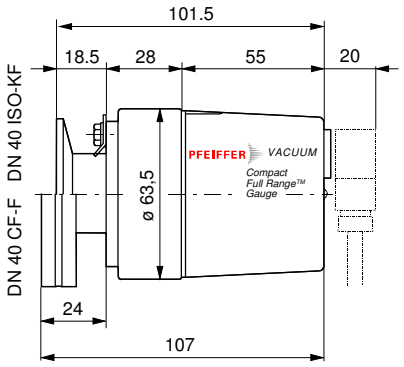


Weight	700 g

PTR26001 (DN 40 ISO-KF)
PTR26002 (DN 40 CF-F)

Materials exposed to the vacuum	
Flange	stainless steel (1.4306/AISI 304L)
Measuring chamber	stainless steel (1.4104)
Feedthrough isolation	ceramic (Al_2O_3), glass
Internal seals	FPM75
Anode	Mo
Ignition aid	stainless steel (1.4310/AISI 301)
Pirani measuring tube	Ni, Au
Pirani filament	W
Internal volume	≈ 20 cm³

Dimensions [mm]



Weight	700 g (DN 40 ISO-KF flange) 950 g (DN 40 CF-F flange)

60W Single Output Industrial DIN Rail Power Supply MDR-60 series

■ Features :

- Universal AC input/Full range
- Protections: Short circuit / Overload / Over voltage
- Cooling by free air convection
- Can be installed on DIN rail TS-35/7.5 or 15
- NEC class 2 / LPS compliant (24V,48V only)
- LED indicator for power on
- DC OK relay contact
- No load power consumption<0.75W
- 100% full load burn-in test
- 3 years warranty

SPECIFICATION

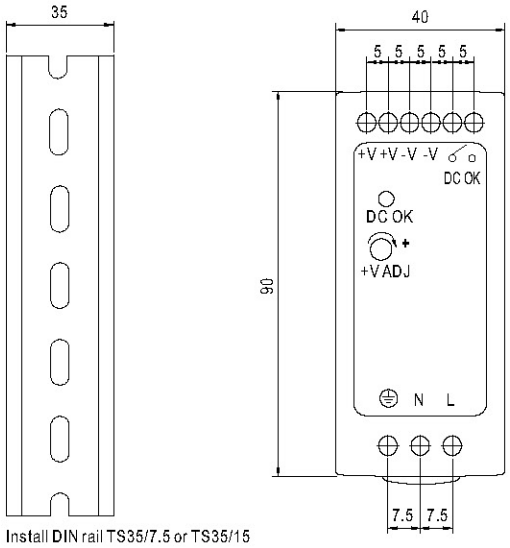
MODEL		428-461	428-467	428-477	428-473
OUTPUT	DC VOLTAGE	5V	12V	24V	48V
	RATED CURRENT	10A	5A	2.5A	1.25A
	CURRENT RANGE	0 ~ 10A	0 ~ 5A	0 ~ 2.5A	0 ~ 1.25A
	RATED POWER	50W	60W	60W	60W
	RIPPLE & NOISE (max.) Note.2	80mVp-p	120mVp-p	150mVp-p	200mVp-p
	VOLTAGE ADJ. RANGE	5 ~ 6V	12 ~ 15V	24 ~ 30V	48 ~ 56V
	VOLTAGE TOLERANCE Note.3	±2.0%	±1.0%	±1.0%	±1.0%
	LINE REGULATION	±1.0%	±1.0%	±1.0%	±1.0%
	LOAD REGULATION	±1.5%	±1.0%	±1.0%	±1.0%
	SETUP, RISE TIME Note.5	500ms, 30ms/230VAC 500ms, 30ms/115VAC at full load			
	HOLD UP TIME (Typ.)	50ms/230VAC 20ms/115VAC at full load			
INPUT	VOLTAGE RANGE	85 ~ 264VAC 120 ~ 370VDC			
	FREQUENCY RANGE	47 ~ 63Hz			
	EFFICIENCY (Typ.)	78%	86%	88%	87%
	AC CURRENT (Typ.)	1.8A/115VAC 1A/230VAC			
	INRUSH CURRENT (Typ.)	COLD START 30A/115VAC 60A/230VAC			
	LEAKAGE CURRENT	<1mA / 240VAC			
PROTECTION	OVERLOAD	105 ~ 150% rated output power			
		Protection type : Constant current limiting, recovers automatically after fault condition is removed			
	OVER VOLTAGE	6.25 ~ 7.25V	15.6 ~ 18V	31.2 ~ 36V	57.6 ~ 64.8V
		Protection type : Shut down o/p voltage, re-power on to recover			
FUNCTION	DC OK SIGNAL	Relay contact rating(max.): 30V/1A resistive			
ENVIRONMENT	WORKING TEMP.	-20 ~ +70℃ (Refer to output load derating curve)			
	WORKING HUMIDITY	20 ~ 90% RH non-condensing			
	STORAGE TEMP., HUMIDITY	-40 ~ +85℃, 10 ~ 95% RH			
	TEMP. COEFFICIENT	±0.03%/℃ (0 ~ 50℃)			
	VIBRATION	Component : 10 ~ 500Hz, 2G 10min./1cycle, period for 60min. each along X, Y, Z axes ; Mounting : Compliance to IEC60068-2-6			
SAFETY & EMC (Note 4)	SAFETY STANDARDS	UL508, TUV EN60950-1 approved, NEC class 2 / LPS compliant (24V,48V only)			
	WITHSTAND VOLTAGE	I/P-O/P:3KVAC I/P-FG:1.5KVAC O/P-FG:0.5KVAC			
	ISOLATION RESISTANCE	I/P-O/P, I/P-FG, O/P-FG:>100M Ohms/500VDC 25℃ 70%RH			
	EMI CONDUCTION & RADIATION	Compliance to EN55011, EN55022 (CISPR22), EN61204-3 Class B			
	HARMONIC CURRENT	Compliance to EN61000-3-2,-3			
	EMS IMMUNITY	Compliance to EN61000-4-2, 3, 4, 5, 6, 8, 11, ENV50204, EN55024, EN61000-6-2, EN61204-3, heavy industry level, criteria A			
OTHERS	MTBF	299.2K hrs min. MIL-HDBK-217F (25℃)			
	DIMENSION	40*90*100mm (W*H*D)			
	PACKING	0.33Kg; 42pcs/14.8Kg/0.82CUFT			

NOTE

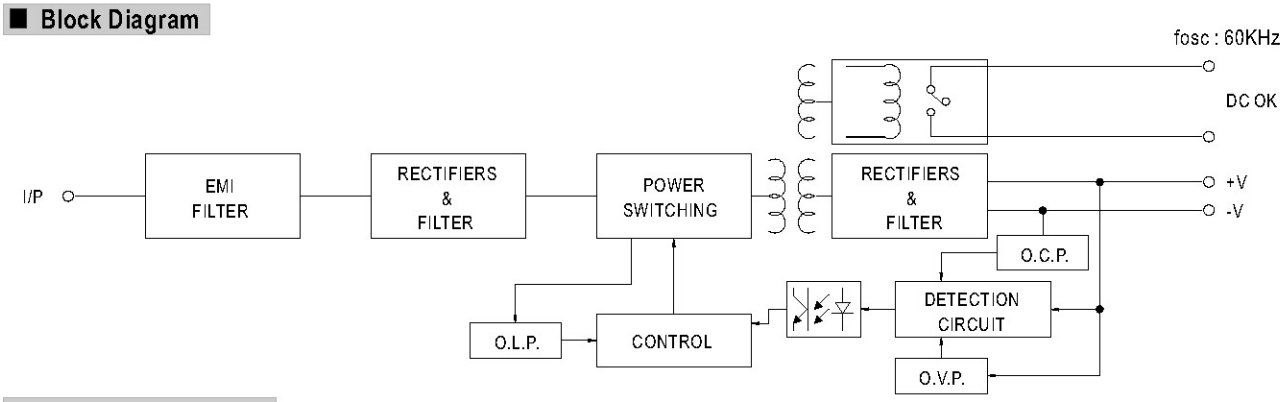
1. All parameters NOT specially mentioned are measured at 230VAC input, rated load and 25℃ of ambient temperature.
2. Ripple & noise are measured at 20MHz of bandwidth by using a 12" twisted pair-wire terminated with a 0.1uf & 47uf parallel capacitor.
3. Tolerance : includes set up tolerance, line regulation and load regulation.
4. The power supply is considered a component which will be installed into a final equipment. The final equipment must be re-confirmed that it still meets EMC directives.
5. Length of set up time is measured at first cold start. Turning ON/OFF the power supply may lead to increase of the set up time.

■ Mechanical Specification

Case No.962A Unit:mm



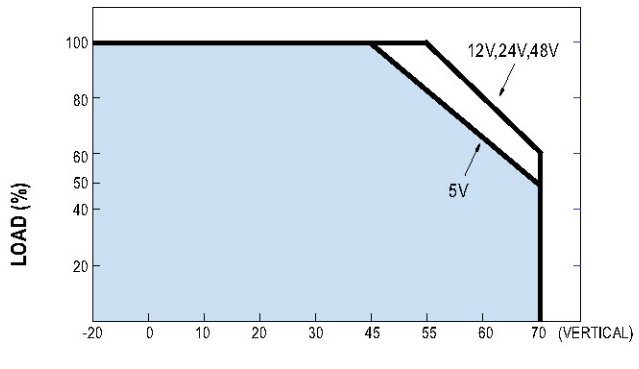
■ Block Diagram



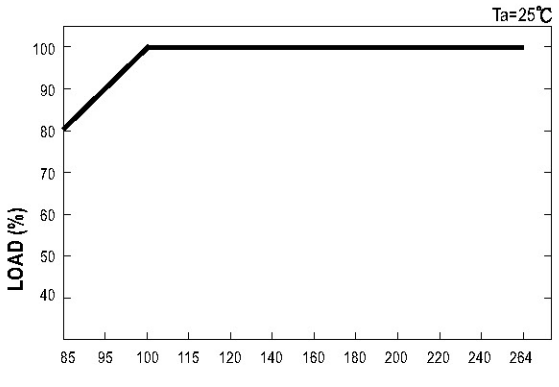
■ DC OK Relay Contact

Contact Close	When the output voltage reaches the adjusted output voltage.
Contact Open	When the output voltage drop below 90% output voltage.
Contact Ratings (max.)	30V/1A resistive load

■ Derating Curve



■ Output Derating VS Input Voltage



Technical Sales
United States
(866) 531-6285
info@ni.com

NI cDAQ-9174

NI CompactDAQ 4-Slot USB Chassis

- Choose from more than 50 hot-swappable I/O modules with integrated signal conditioning
- Four general-purpose 32-bit counter/timers built into chassis (access through digital module)
- Run up to seven hardware-timed analog I/O, digital I/O, or counter/timer operations simultaneously
- Stream continuous waveform measurements with patented NI Signal Streaming technology
- Windows 7 OS support
- Measure in minutes with NI-DAQmx software and automatic code generation using the DAQ Assistant

Overview

The NI cDAQ-9174 is a 4-slot NI CompactDAQ USB chassis designed for small, portable, mixed-measurement test systems. Combine the cDAQ-9174 with up to four NI C Series I/O modules for a custom analog input, analog output, digital I/O, and counter/timer measurement system.

Modules are available for a variety of sensor measurements including thermocouples, RTDs, strain gages, load and pressure transducers, torque cells, accelerometers, flow meters, and microphones. NI CompactDAQ systems combine sensor measurements with voltage, current, and digital signals to create custom, mixed-measurement systems with a single, simple USB cable back to the PC, laptop, or netbook.

The cDAQ-9174 has four 32-bit general-purpose counter/timers built in. You can access these counters through an installed, hardware-timed digital NI C Series module such as the NI 9401 or NI 9402 for applications that involve quadrature encoders, PWM, event counting, pulse train generation, and period or frequency measurement.

The cDAQ-9174 chassis is shipped with the following:

- AC/DC converter that plugs directly into the chassis

- USB cable with a thumbscrew lock for strain relief

Power cord sold separately.

NI-DAQmx driver software is shipped with every chassis and includes the following:

- LabVIEW SignalExpress LE for simple data-logging applications

- API for LabVIEW, ANSI C/C++, C#, and Visual Basic .NET

- DAQ Assistant code generation for NI LabVIEW, LabWindows™/CVI, and Measurement Studio

- Example programs for all supported languages

- NI Measurement & Automation Explorer (MAX) for system configuration and test

The mark LabWindows is used under a license from Microsoft Corporation. Windows is a registered trademark of Microsoft Corporation in the United States and other countries.

Specifications

Specifications Documents

- Specifications
- Data Sheet

Specifications Summary

General	
Product Name	cDAQ-9174
Form Factor	CompactDAQ
Part Number	781157-01
Operating System/Target	Windows
LabVIEW RT Support	No
Operating Relative Humidity	10 percent , 90 percent
Chassis	
Number of Slots	4
Total Available Power	15 W
Input Voltage Range	9 V , 30 V
Built-In Trigger	No
Counter/Timers	
Counters	4
Resolution	32 bits
Bus Interface	
USB Specification	USB 2.0 Hi-Speed
High-Performance Data Streams	7
Types Available	Digital Output , Analog Input , Analog Output , Counter/Timer Input , Digital Input
Shock and Vibration	
Operational Shock	30 g
Random Operating Frequency Range	5 Hz , 500 Hz
Random Vibration	0.3 g
Physical Specifications	

Length	15.9 cm
Width	8.81 cm
Height	5.89 cm
Weight	574 gram
Minimum Operating Temperature	-20 °C
Maximum Operating Temperature	55 °C
Maximum Altitude	2000 m

Pricing

Part Number	Description	Est Ship	US Dollars*	Qty
NI CompactDAQ Chassis				
781157-01	cDAQ-9174, CompactDAQ chassis (4 slot USB)	--	For prices, Select Country	
781156-01	cDAQ-9178, CompactDAQ chassis (8 slot USB)	--	For prices, Select Country	
Common Starter Accessories				
763000-01	Power Cord, AC, U.S., 120 VAC, 2.3 meters	--	For prices, Select Country	
763068-01	Power Cord, 240V, 10A, North American	--	For prices, Select Country	
779473-01	NI 9901 Desktop Mounting Kit	--	For prices, Select Country	
196917-01	NI 9977 C Series Filler Module for Empty Slot	--	For prices, Select Country	
777550-01	USB/PCMCIA Cable Strain Relief for Laptop	--	For prices, Select Country	
780315-01	Rugged Carrying Case for Portable Instrumentation	--	For prices, Select Country	
781233-01	EMI Suppression Ferrite, 7.0mm	--	For prices, Select Country	
780702-01	2-Position Screw Terminal Kit for Power Supply Connection, Qty 4	--	For prices, Select Country	

* You have selected the United States as the country where you will use the product(s). Pricing may have changed since you printed this document on 02/22/2011. Please visit *ni.com* to see current pricing.

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2 . Once you have added your items to your cart, see the "Your Cart Options" section to place your order, obtain a quote, or print a fax form.

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ni.switzerland@ni.com

4-Ch Universal Measurement Device for USB, Ethernet, or Wi-Fi

NI 9219 Module with 1-slot NI CompactDAQ Chassis

- Bundle includes measurement module and 1-slot NI CompactDAQ chassis
- USB, Ethernet, and 802.11 Wi-Fi connectivity
- 250 Vrms channel-to-channel isolation
- Built-in quarter-, half-, and full-bridge support
- Built-in voltage and current excitation
- Thermocouple, RTD, resistance, voltage, and current measurements

Overview

The NI 9219 Measurement System measures 4 universal channels at 100 S/s with 24-bit resolution, sending data to a host PC over USB, Ethernet or 802.11 Wi-Fi.

Measurement Bundle Overview

The hardware for an NI CompactDAQ single measurement bundle consists of a USB, Ethernet, or 802.11 Wi-Fi chassis and one of the over 50 NI C Series measurement-specific modules. These small rugged bundles are ideal for portable or distributed measurements.

Chassis

The chassis controls the timing for the module and handles communication with the PC over the USB, Ethernet, or 802.11 Wi-Fi bus. Additionally, all NI CompactDAQ chassis include four counter/timers that you can access through a digital I/O module like the NI 9401.

Module

The NI 9219 is a 4-channel universal C Series module designed for multipurpose testing in any NI CompactDAQ or CompactRIO chassis. With the NI 9219, you can measure several signals from sensors such as strain gages, resistance temperature detectors (RTDs), thermocouples, load cells, and other powered sensors. The channels are individually selectable, so you can perform a different measurement type on each of the four channels. Measurement ranges differ for each type of measurement and include up to ±60 V for voltage and ±25 mA for current. See the manual for detailed specifications and ranges.

Because of the driver design, the NI 9219 does not limit the overall speed of an NI CompactDAQ system when used with faster sampling modules.

With 250 Vrms of channel-to-channel isolation, the NI 9219 protects not only the surrounding modules, chassis, and connected computer system but also the other channels within the same module. In addition to increased safety, channel-to-channel isolation eliminates problems associated with ground loops.

The NI 9219 uses 6-position spring terminal connectors in each channel for direct signal connectivity. You can purchase additional

connectors to reduce signal connection time for multiple test units. In addition to extra connectors, a strain relief kit is available to secure the signal wires.

-Strain relief backshells for signal wire security and high-voltage protection (qty 4): NI 9972

-Extra connectors for 6-position connector modules (qty 10): NI 9973

Specifications

Specifications Documents

- Specifications (5)

Specifications Summary

General	
Product Name	NI 9219 Measurement Bundle
Product Family	Industrial I/O , Signal Conditioning
Form Factor	USB , Wireless , CompactDAQ , Ethernet
Part Number	000000-00
Operating System/Target	Real-Time , Windows
Measurement Type	Current , Resistance , Temperature , RTD , Strain/Bridge-based sensor , Thermocouple , Voltage
RoHS Compliant	Yes
Signal Conditioning	Current excitation , Cold-junction compensation , Voltage excitation , Bridge completion , 0-20 mA current input
Analog Input	
Channels	4 , 0
Single-Ended Channels	0
Differential Channels	4
Resolution	24 bits
Sample Rate	100 S/s
Max Voltage	60 V
Maximum Voltage Range	-60 V , 60 V
Maximum Voltage Range Accuracy	243 mV
Minimum Voltage Range	-0.125 V , 0.125 V
Minimum Voltage Range Accuracy	271 µV
Maximum Current Range	-0.025 A , 0.025 A
Maximum Current Range Accuracy	152 µA
Simultaneous Sampling	Yes

Excitation Voltage	2.5 V
Bridge Configurations	Half Bridge , Full Bridge , Quarter Bridge
Analog Output	
Channels	0
Digital I/O	
Bidirectional Channels	0
Input-Only Channels	0
Output-Only Channels	0
Counter/Timers	
Counters	0
Physical Specifications	
Length	9 cm
Width	2.3 cm
I/O Connector	MINI-COMBICON, 3.81 mm (6-Position)
Minimum Operating Temperature	0 °C
Maximum Operating Temperature	55 °C
Minimum Storage Temperature	-10 °C
Maximum Storage Temperature	70 °C
Timing/Triggering/Synchronization	
Triggers cDAQ Chassis	No

Pricing

NI 9219

Bundle Contents

Estimated Shipping Days : 1 - 2

Price: Sfr 1,670

Choose a communication method between your PC and module.

USB Option

NI cDAQ-9171, 1-Slot USB Chassis 781425-01 Included in price

Ethernet Option

NI cDAQ-9181, 1-Slot Ethernet Chassis 781496-01 Add Sfr 90

Technical Sales
Switzerland
056 200 51 51
ni.switzerland@ni.com

NI 9263 Measurement System

4 Ch, 100 kS/s Voltage Output for USB, Ethernet, and Wi-Fi

- Bundle includes measurement module and 1-slot NI CompactDAQ chassis
- USB, Ethernet, and 802.11 Wi-Fi connectivity
- 4 simultaneously updated analog outputs, 100 kS/s
- 16-bit resolution
- Hot-swappable operation

Overview

The NI 9263 Measurement System can output four voltage signals at 100 kS/s with 16-bit resolution, communicating with a host PC over USB, Ethernet or 802.11 Wi-Fi.

Measurement Bundle Overview

The hardware for an NI CompactDAQ single measurement bundle consists of a USB, Ethernet, or 802.11 Wi-Fi chassis and one of the over 50 NI C Series measurement-specific modules. These small rugged bundles are ideal for portable or distributed measurements.

Chassis

The chassis controls the timing for the module and handles communication with the PC over the USB, Ethernet, or 802.11 Wi-Fi bus. Additionally, all NI CompactDAQ chassis include four counter/timers that you can access through a digital I/O module like the NI 9401.

Module

The NI 9263 is a 4-channel, 100 kS/s simultaneously updating analog output module for any NI CompactDAQ or CompactRIO chassis. It features ±30 V overvoltage protection, short-circuit protection, low crosstalk, a fast slew rate, high relative accuracy, and NIST-traceable calibration. The NI 9263 module includes a channel-to-earth ground double isolation barrier for safety and noise immunity.

Specifications

Specifications Documents

- Specifications (4)

Specifications Summary

General	
Product Name	NI 9263 Measurement Bundle

Product Family	Industrial I/O
Form Factor	Ethernet , USB , Wireless , CompactDAQ
Part Number	000000-00
Operating System/Target	Real-Time , Windows
Measurement Type	Voltage
RoHS Compliant	Yes
Analog Input	
Channels	0
Single-Ended Channels	0
Differential Channels	0
Analog Output	
Channels	4
Resolution	16 bits
Max Voltage	10 V
Maximum Voltage Range	-10 V , 10 V
Maximum Voltage Range Accuracy	0.11 V
Minimum Voltage Range	-10 V , 10 V
Minimum Voltage Range Accuracy	0.11 V
Update Rate	100 kS/s
Digital I/O	
Bidirectional Channels	0
Input-Only Channels	0
Output-Only Channels	0
Counter/Timers	
Counters	0
Physical Specifications	
Length	9 cm
Width	2.3 cm
I/O Connector	Screw terminals
Minimum Operating Temperature	-40 °C
Maximum Operating Temperature	70 °C

Minimum Storage Temperature	-40 °C
Maximum Storage Temperature	85 °C
Timing/Triggering/Synchronization	
Triggers cDAQ Chassis	No

Pricing

NI 9263

Bundle Contents

Estimated Shipping Days : 1 - 2

Price: Sfr 855

Choose a communication method between your PC and module.

USB Option

NI cDAQ-9171, 1-Slot USB Chassis 781425-01 Included in price

Ethernet Option

NI cDAQ-9181, 1-Slot Ethernet Chassis 781496-01 Add Sfr 90

NI cDAQ-9181 CompactDAQ Chassis (1-SLOT Ethernet), Conformal Coat 782052-01 Add Sfr 350

WI-FI Option

NI cDAQ-9191, 1-Slot WI-FI Chassis (U.S.) 781497-01 Add Sfr 130

NI cDAQ-9191, 1-Slot WI-FI Chassis (International) 781497-02 Add Sfr 130

Analog Output Module

NI 9263 4 ch,16-bit, +/-10 V, 100 kS/s/Ch, AO Module 779012-01 Included in price

Power

Power Cord, 220V, 10A, Swiss 763065-01 Add Sfr 12

Power Cord, 240V, 10A, Euro, Right Angle 763067-01 Add Sfr 12

Software

Technical Sales
United States
(866) 531-6285
info@ni.com

NI 9211 Measurement System

4 Ch Thermocouple Input for USB, Ethernet, or Wi-Fi

- Bundle includes measurement module and 1-slot NI CompactDAQ chassis
- USB, Ethernet, and 802.11 Wi-Fi connectivity
- 4 thermocouple or ±80 mV analog inputs
- 24-bit resolution; 50/60 Hz noise rejection
- NIST-traceable calibration
- Hot-swappable operation

Overview

The NI 9211 Measurement System measures 4 thermocouple channels at 14 S/s with 24-bit resolution, sending data to a host PC over USB, Ethernet or 802.11 Wi-Fi.

Measurement Bundle Overview

The hardware for an NI CompactDAQ single measurement bundle consists of a USB, Ethernet, or 802.11 Wi-Fi chassis and one of over 50 NI C Series measurement-specific modules. These small rugged bundles are ideal for portable or distributed measurements.

Chassis

The chassis controls the timing for the module and handles communication with the PC over the USB, Ethernet, or 802.11 Wi-Fi bus. Additionally, all NI CompactDAQ chassis include four counter/timers that you can access through a digital I/O module like the NI 9401.

Module

The NI 9211 thermocouple input module for use with NI CompactDAQ and CompactRIO chassis includes a 24-bit delta-sigma analog-to-digital converter, antialiasing filters, open-thermocouple detection, and cold-junction compensation for high-accuracy thermocouple measurements. The NI 9211 contains NIST-traceable calibration and channel-to-earth ground double isolation barrier for safety, noise immunity, and high-common-mode voltage range.

Specifications

Specifications Documents

- Specifications (3)

Specifications Summary

General	
Product Name	NI 9211 Measurement Bundle

Product Family	Industrial I/O
Form Factor	Ethernet , USB , Wireless , CompactDAQ
Part Number	000000-00
Operating System/Target	Real-Time , Windows
Measurement Type	Thermocouple , Voltage , Temperature
RoHS Compliant	Yes
Signal Conditioning	Cold-junction compensation
Analog Input	
Channels	4 , 0
Single-Ended Channels	0
Differential Channels	4
Resolution	24 bits
Sample Rate	14 S/s
Max Voltage	80 mV
Maximum Voltage Range	-80 mV , 80 mV
Minimum Voltage Range	-80 mV , 80 mV
Simultaneous Sampling	No
Analog Output	
Channels	0
Digital I/O	
Bidirectional Channels	0
Input-Only Channels	0
Output-Only Channels	0
Number of Channels	0
Counter/Timers	
Counters	0
Physical Specifications	
Length	9 cm
Width	2.3 cm
I/O Connector	Screw terminals
Minimum Operating Temperature	-40 °C

Maximum Operating Temperature	70 °C
Minimum Storage Temperature	-40 °C
Maximum Storage Temperature	85 °C
Timing/Triggering/Synchronization	
Triggers cDAQ Chassis	No

Pricing

NI 9211

Bundle Contents

Estimated Shipping Days : 10 - 15 **Price : $ 607**

- **Choose a communication method between your PC and module.**

USB Option

NI cDAQ-9171, 1-Slot USB Chassis 781425-01 (Included in price)

Ethernet Option

NI cDAQ-9181, 1-Slot Ethernet Chassis 781496-01 Add $ 100

NI cDAQ-9181 CompactDAQ Chassis (1-SLOT Ethernet), Conformal Coat 782052-01 Add $ 240

WI-FI Option

NI cDAQ-9191, 1-Slot WI-FI Chassis (U.S.) 781497-01 Add $ 200

NI cDAQ-9191, 1-Slot WI-FI Chassis (International) 781497-02 Add $ 200

- **Analog Input Module**

NI 9211 4-Ch ±80 mV, 14 S/s, 24-Bit TC and Diff AI 779001-01 (Included in price)

- **Power**

Power Cord, AC, U.S., 120 VAC, 2.3 meters 763000-01 (Included in price)

Power Cord, 240V, 10A, North American 763068-01 Add $ 19

- **Software**

LabVIEW Full Development System, Windows, English, Include 1 Year SSP 776670-35 Add $ 2,699

Estimated Shipping Days : 10 - 15 **Price : $ 607**

Basler ace

AREA SCAN CAMERAS

- Best price/performance ratio
- USB 3.0 – easiest way for plug and play
- Gigabit Ethernet interface with PoE
- Camera Link interface with PoCL
- Broad sensor selection: CCD, CMOS, NIR versions

BASLER
the power of sight

OVERVIEW

All You Need is ace

The Basler ace camera line covers the entire spectrum including cost sensitivity, ultra-fast speeds and high tech in a very small housing. The camera's price-driven design underpins our quality commitment by applying the technical knowledge we've acquired from former camera designs. High quality and performance levels combined with a low starting list price of only €199 make Basler ace cameras one of the world's best selling cameras with thousands of satisfied customers.

With the ace series, you can choose from the most popular data interfaces in the vision market: the popular Gigabit Ethernet interface with 100-meter cable length, the new USB 3.0 interface with plug and play capability, and the field-proven Camera Link interface with wide bandwidth. All Basler ace cameras come with an option to provide camera power and data via a single cable. They also offer separate input/output ports for triggering or flash control. And like all Basler cameras, the ace family comes with a long list of firmware features.

Analog cameras are very easy to replace because the Basler ace offers the same 29 x 29 mm footprint and the same bottom mounting options that have been standard on analog cameras for many years. Some existing Camera Link, FireWire, and USB 2.0 cameras with the same 29 x 29 mm footprint can also be replaced. The Basler ace matches most of these cameras in terms of mechanics, and often beats them on price and ease of use.

Want to do things better? Then get yourself one of these innovative digital cameras that are specifically targeted at industrial, medical, and traffic applications – and profit from a convincing price/performance ratio to boot. This ace of cameras is available with several resolutions and speeds, and with sensors from all leading manufacturers so you can easily find the right ace camera model for your application. Basler ace is all you need.

Your benefits include:

- Support for standard vision interfaces GigE Vision, USB3 Vision, and Camera Link
- Broadest sensor portfolio ever: CMOS and CCD including NIR-enhanced versions, I/O flexibility with minimum delay and jitter time
- One cable solutions: Gigabit Ethernet with PoE, Camera Link with PoCL, USB 3.0
- Field-proven Basler pylon Camera Software Suite with advanced drivers
- Outstanding price/performance ratio

TECHNICAL DETAILS

Specifications

Basler ace	acA1920-25um/uc NEW	acA2500-14um/uc	acA3800-14um/uc* NEW	acA4600-10uc* NEW
Camera				
Resolution (H x V pixels)	1920 x 1080	2592 x 1944	3856 x 2764	4608 x 3288
Sensor	Aptina MT9P031	Aptina MT9P	Aptina MT9J003	Aptina MT9F002
Sensor Size (optical)	1/3.7“	1/2.5“	1/2.3"	1/2.3"
Sensor Technology	CMOS, rolling shutter			
Pixel Size (µm)	2.2 x 2.2	2.2 x 2.2	1.67 x 1.67	1.4 x 1.4
Frame Rate	25	14	14	10
Mono / Color	Mono/Color			Color
Video Output Format	Mono 8, Mono 12, Mono 12 Packed, YUV 4:2:2 Packed, YUV 4:2:2 (YUYV) Packed, Bayer BG 8, Bayer BG 12, Bayer BG 12 Packed			
Interface	USB 3.0			
Synchronization	Via external trigger or free-run			
Exposure Control	Via external trigger or programmable via the camera API			
Mechanical / Electrical				
Housing Size (L x W x H)	29.3 mm x 29 mm x 29 mm			
Housing Temperature	Up to 50 °C			
Lens Mount	C, CS	C, CS	C, CS	C, CS
Digital I/O	1 opto-isolated input + 1 opto-isolated output + 2 Fast-GPIO (configurable as In/Out)			
Power Requirements	Via USB 3.0 interface			
Power Suspend Mode	Yes, less than 0.02 W, configurable			
Power Consumption (typical)	2.2 W	2.2 W	2.2 W (preliminary)	2.2 W (preliminary)
Weight (typical)	<80 g			
Conformity	CE, FCC, IP30, RoHS, UL (in preparation), USB3 Vision, USB-IF (in preparation)			
Software / Driver				
Driver	Basler pylon Camera Software Suite or 3rd party USB3 Vision Software			
Operating System	Windows 32 bit and 64 bit			
Conformity	USB3 Vision, GenICam			

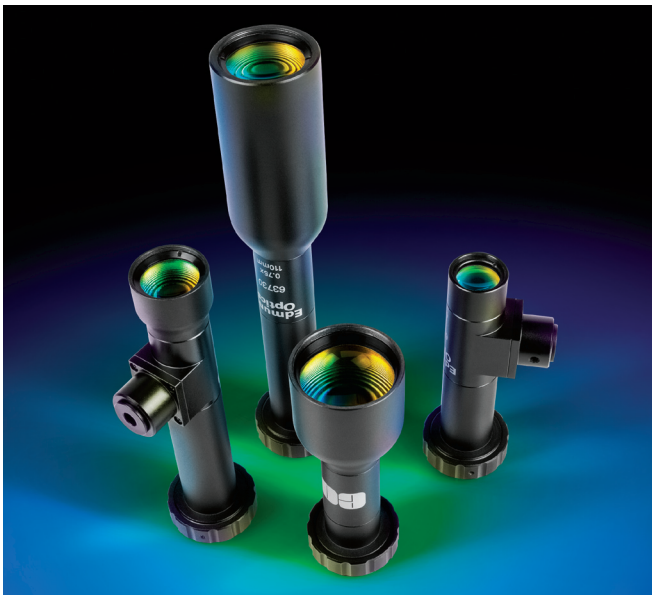
Specifications are subject to change without prior notice. Latest specifications can be found on our website. Please visit www.baslerweb.com/manuals for the detailed camera User’s Manual and www.baslerweb.com/thirdparty for information on third party software.

* Available Q2/2014

TECHSPEC® COMPACT TELECENTRIC LENS

#63-743 • 65MM WD • 6.0X

Our TECHSPEC® Compact Telecentric Lenses were designed with customer requirements in mind. Featuring large maximum sensor formats and a number of different working distance/magnification options, the TECHSPEC® Compact Telecentric Lenses are perfect for many applications. From single unit inspection stations, to high volume implementation, these Compact Telecentric Lenses are engineered to provide the specifications you need at a competitive price point.



Primary Magnification:	6.0X
Working Distance[1]:	65mm ±1mm
Depth of Field[2]:	±0.05mm (20% @ 20 lp/mm)
Length:	116.1mm
Filter Thread:	M17 x 0.5
Max. Sensor Format:	⅔"
Camera Mount:	C-Mount

Telecentricity:	<0.2°
Distortion:	<0.2%
Resolution[2]:	>7% @ 40 lp/mm
Aperture (f/#):	f35.0, fixed
Object Space NA:	0.085
Number of Elements (Groups):	5 (3)
AR Coating:	425 - 675nm BBAR
Weight:	60g

Sensor Size	¼"	⅓"	½.5"	½"	⅓.8"	⅔"	1"	4⁄3"
Field of View[3]	0.6mm	0.8mm	0.95mm	1.05mm	1.2mm	1.45mm	N/A	N/A

1. From front of housing 2. Image space MTF contrast 3. Horizontal FOV on standard 4:3 sensor format

Specifications subject to change

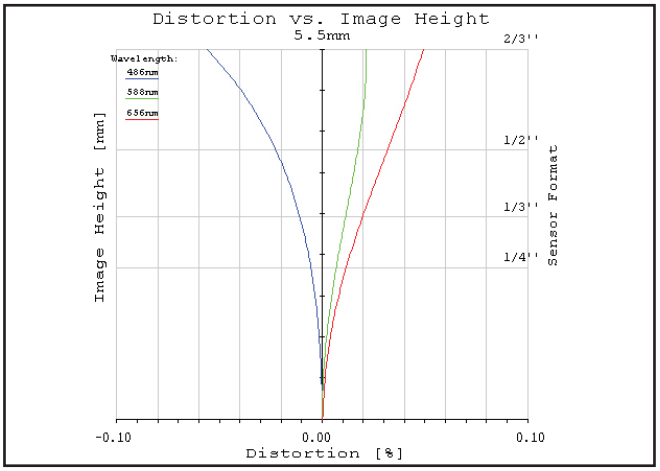


Figure 1: Distortion at the maximum sensor format. Positive values correspond to pincushion distortion, negative values correspond to barrel distortion.

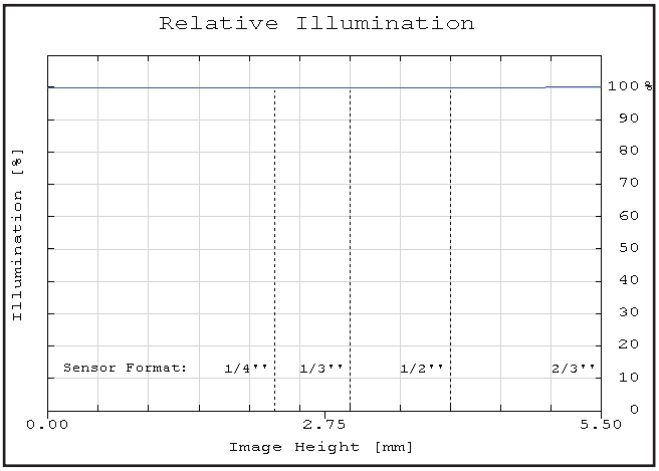


Figure 2: Relative illumination (center to corner)

In both plots, field points corresponding to the image circle of common sensor formats are included. Plots represent theoretical values from lens design software. Actual lens performance varies due to manufacturing tolerances.

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TECHSPEC® COMPACT TELECENTRIC LENS
#63-743 • 65MM WD • 6.0X

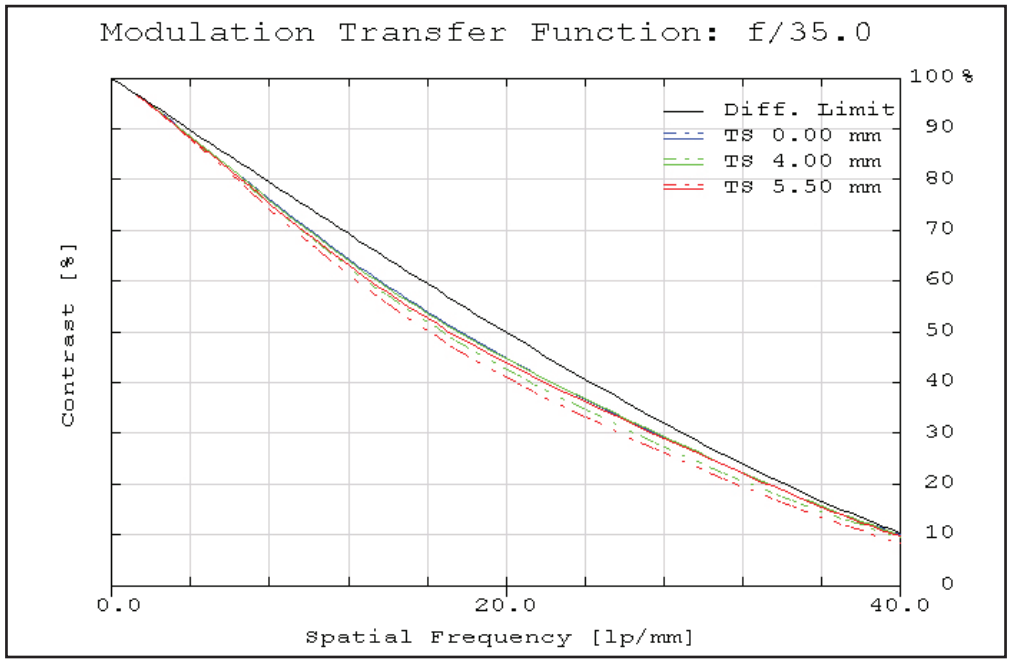

Figure 3: Image space polychromatic diffraction FFT Modulation Transfer Function (MTF) for λ = 486nm to 656nm. Included are Tangential and Sagittal values for field points on center, at 70% of full field and at the maximum sensor format. Solid black line indicates diffraction limit determined by f/#-defined aperture. Frequencies corresponding to the Nyquist resolution limit of pixel sizes are indicated.

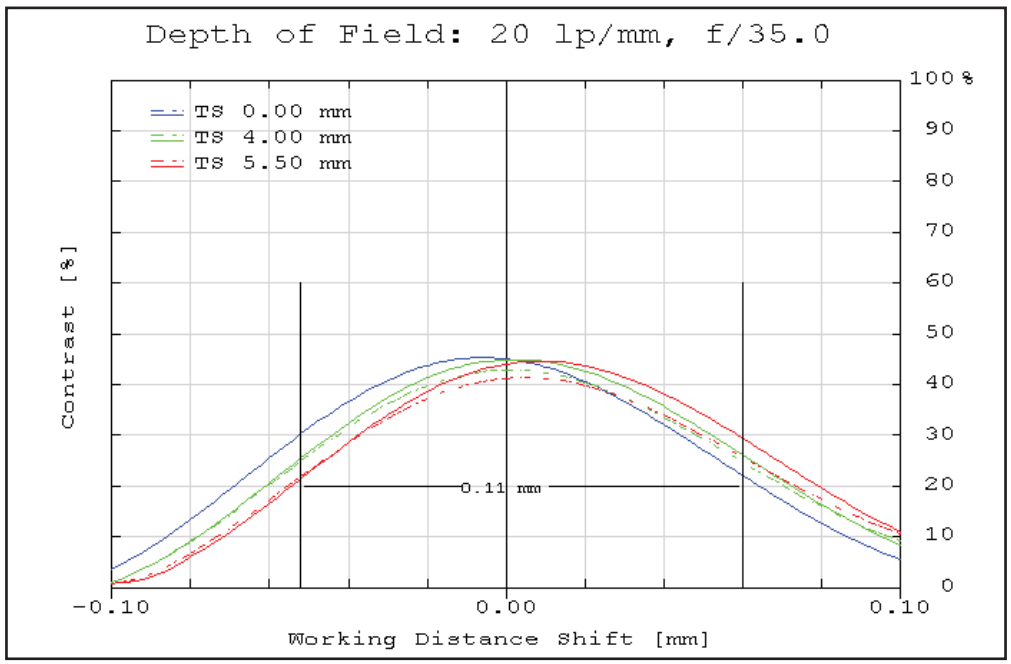

Figure 4: Polychromatic diffraction through-focus MTF at 20 linepairs/mm (image space). The depth of field at the maximum sensor format for the plotted frequency and f/# at 20% contrast is indicated by the measurement bars.

Plots represent theoretical values from lens design software. Actual lens performance varies due to manufacturing tolerances.

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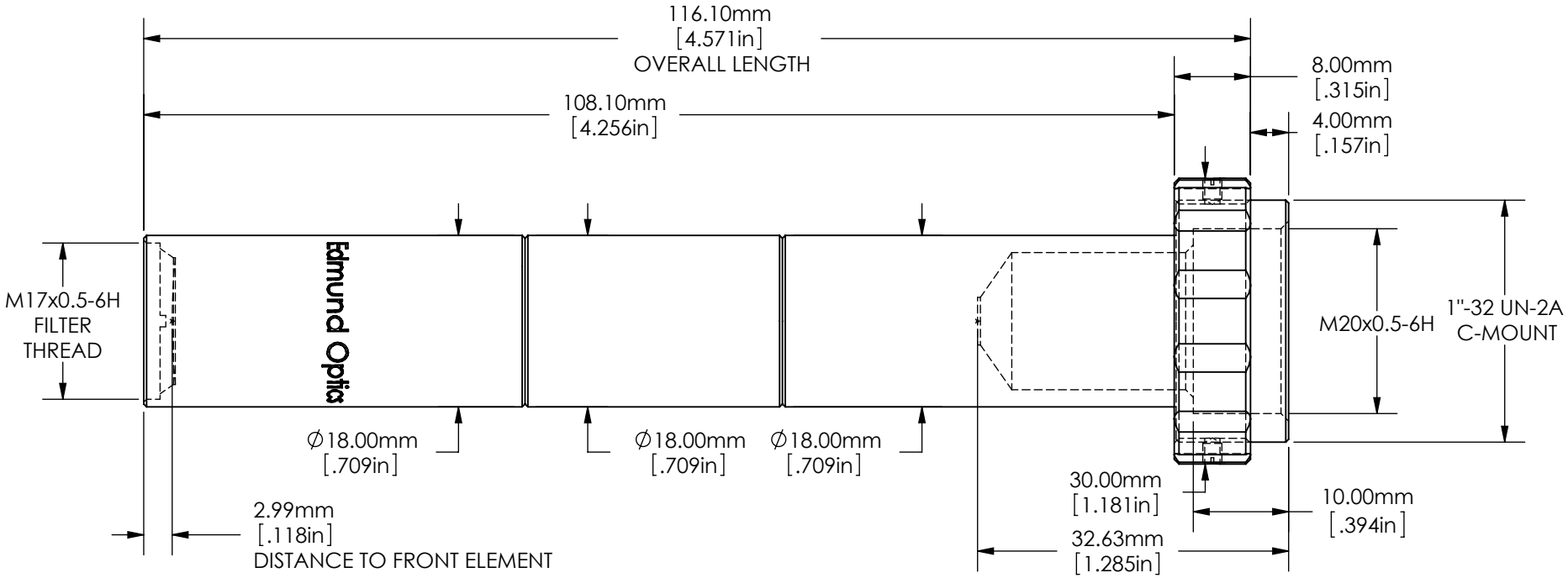
SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE
DIMENSIONS ARE FOR REFERENCE ONLY
DIMENSIONS ARE IN mm [INCHES]

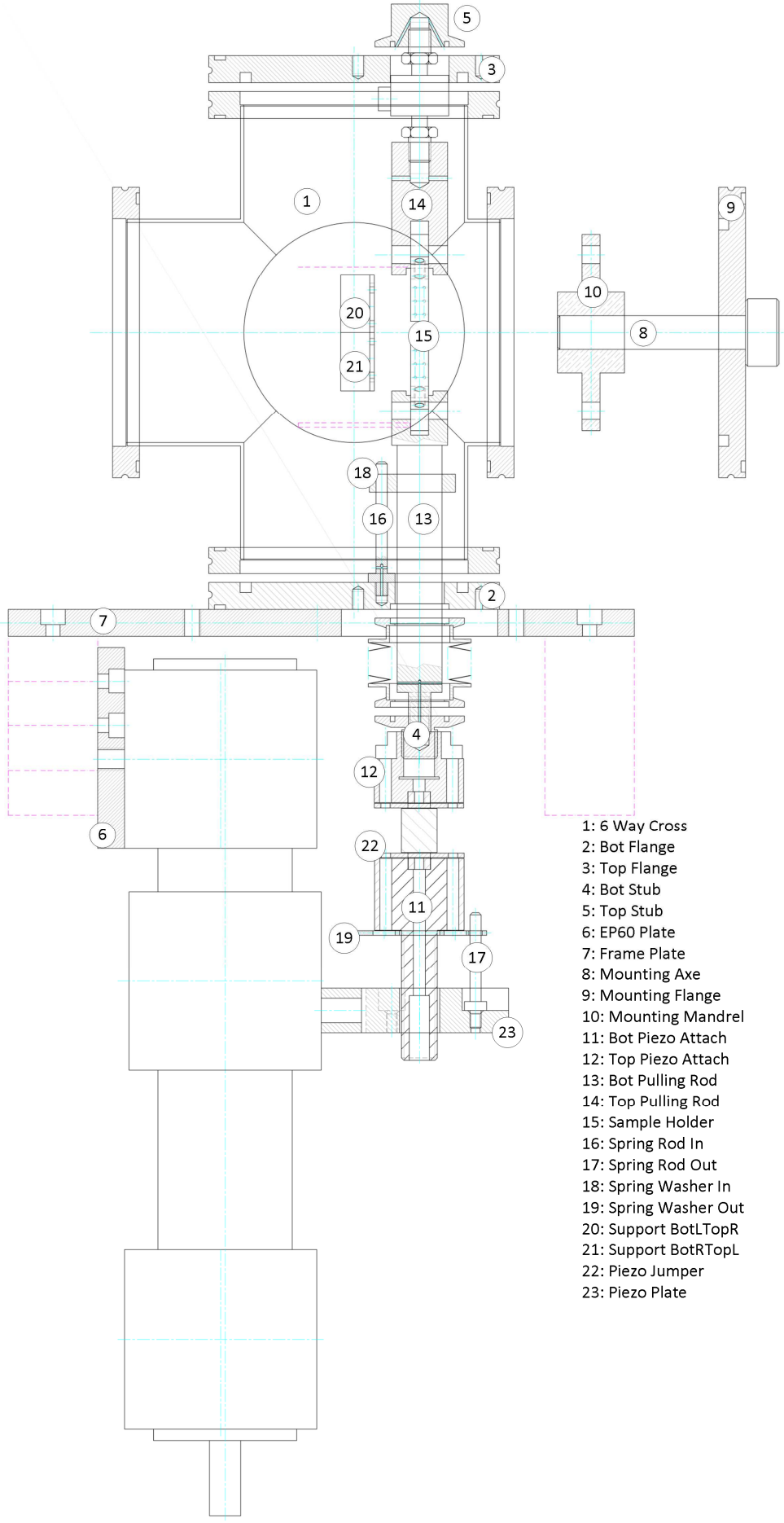


PRIMARY MAGNIFICATION (PMAG)	6X
HORIZ. FOV RANGE ON MAX 2/3" SENSOR	1.5mm
HORIZ. FOV RANGE ON 1/2" SENSOR	1.1mm
HORIZ. FOV RANGE ON 1/3" SENSOR	0.8mm
WORKING DISTANCE	65mm±1
TELECENTRICITY	< 0.2°
DISTORTION	< 0.2%
MOUNT (FLANGE DISTANCE)	17.5mm
APERTURE (f/#)	f35

Edmund Optics®

TITLE	6x Compact Telecentric Lens, 65mm Working Distance		
DWG NO	63743 SHEET 1 OF 1	REV	000

ANNEX B: DRAFTS



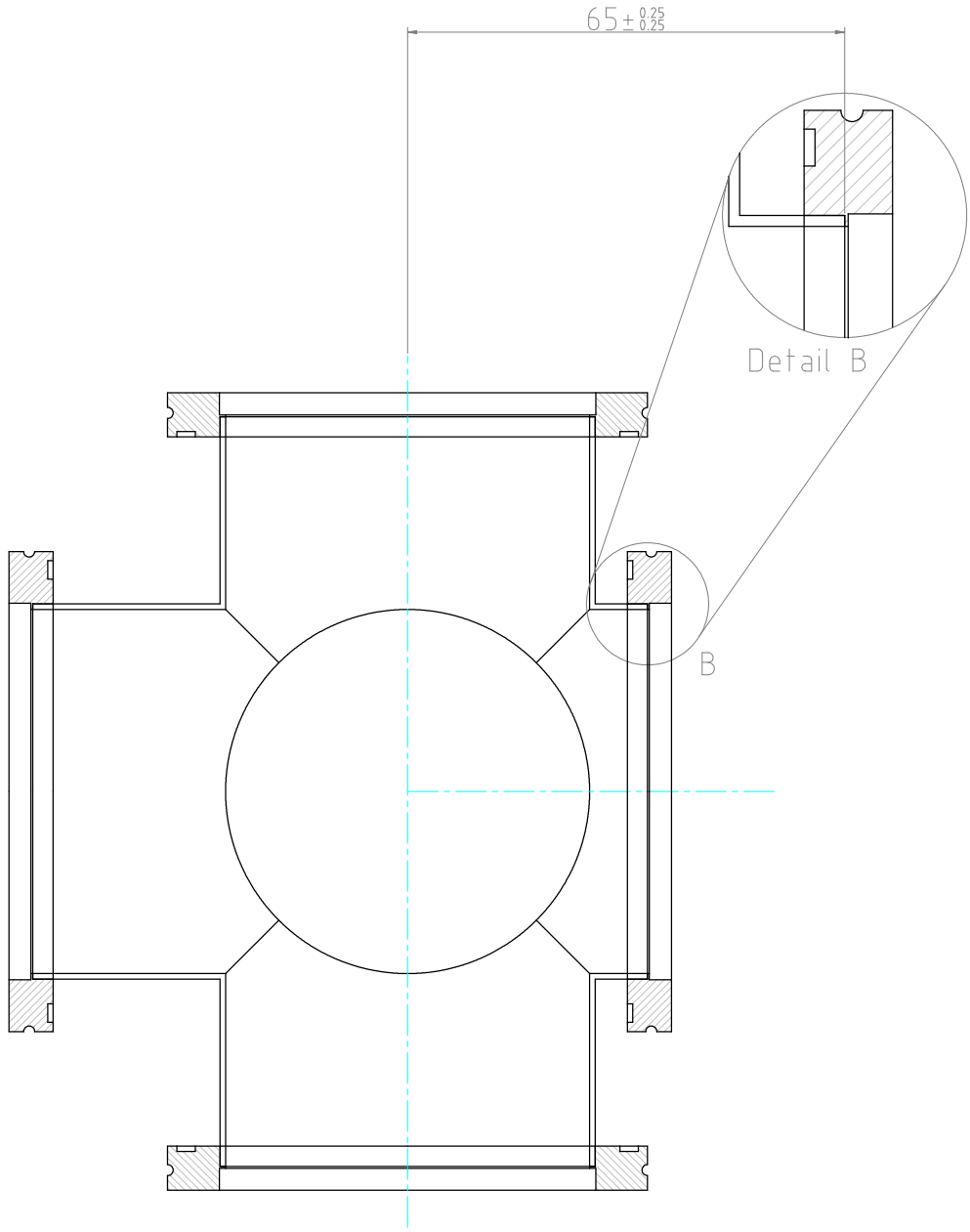
1: 6 Way Cross
2: Bot Flange
3: Top Flange
4: Bot Stub
5: Top Stub
6: EP60 Plate
7: Frame Plate
8: Mounting Axe
9: Mounting Flange
10: Mounting Mandrel
11: Bot Piezo Attach
12: Top Piezo Attach
13: Bot Pulling Rod
14: Top Pulling Rod
15: Sample Holder
16: Spring Rod In
17: Spring Rod Out
18: Spring Washer In
19: Spring Washer Out
20: Support BotLTopR
21: Support BotRTopL
22: Piezo Jumper
23: Piezo Plate

Part #	Name	Material	Remarks	Qty.
1	6wayCross100	Stainless Steel	To be modified, provided by Hositrad	1
2	blankFlange__bot	Stainless Steel	To be modified, provided by Hositrad	1
3	blankFlange__top	Stainless Steel	To be modified, provided by Hositrad	1
4	blankStub__bot	Stainless Steel	To be modified, provided by Hositrad	1
5	blankStub__top	Stainless Steel	To be modified, provided by Hositrad	1
6	EP60Plate	Stainless Steel		1
7	framePlate	Stainless Steel		1
8	mountingAxe	Aluminium		1
9	mountingFlange	Stainless Steel	To be modified, provided by Hositrad	1
10	mountingMandrel	Aluminium		1
11	piezoAttach__bot	Stainless Steel		1
12	piezoAttach__top	Stainless Steel		1
13	pullingRod__bot	Stainless Steel		1
14	pullingRod__top	Stainless Steel		1
15	sampleHolder	Stainless Steel		2
16	springRod__in	Stainless Steel		3
17	springRod__out	Stainless Steel		3

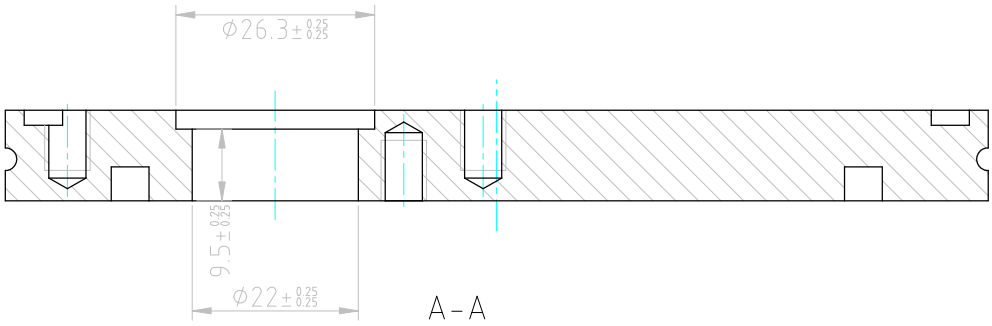
X	DIC Equipment		Page 1/30
A4			27-09-2013
	Nuclear Fuels Project	Piece List	S. Valance M. Raventos

Part #	Name	Material	Qty.
18	springWasher__in	Stainless Steel	1
19	springWasher__out	Aluminium	1
20	supportIR__botLtopR	Aluminium	3
21	supportIR__botRtopL	Aluminium	3
22	piezoJumper	Stainless Steel	2
23	piezoPlate	Stainless Steel	1
24	equerreIR__side	Aluminium	2
25	equerreIR__back	Aluminium	1
26	centralDeck	Stainless Steel	1
27	sampleHolder__blocker	Stainless Steel	2
28	camera__support	Aluminium	1

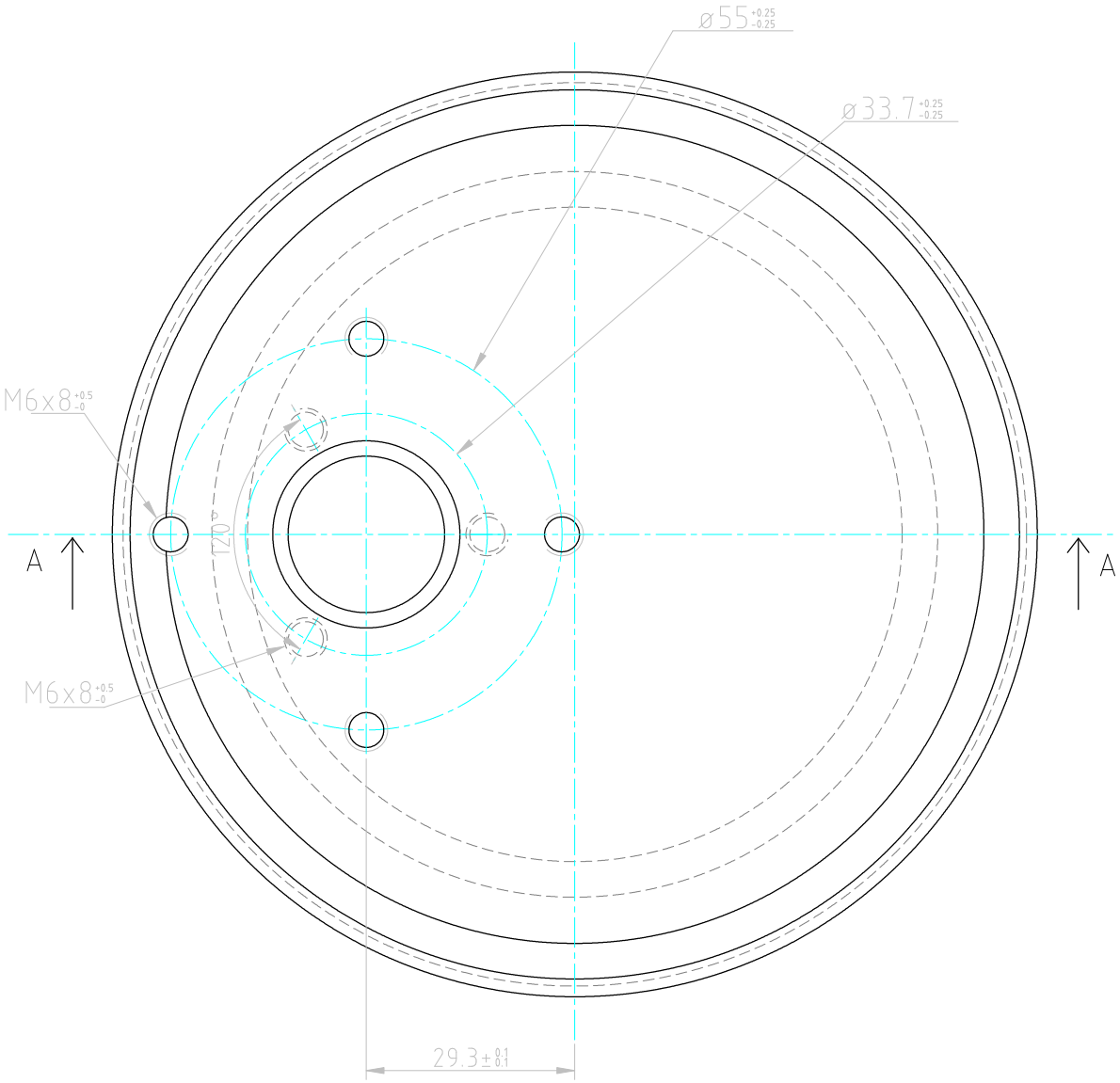
X	DIC Equipment		Page 2/30
A4			27-09-2013
	Nuclear Fuels Project	Piece List	S. Valance M. Raventos



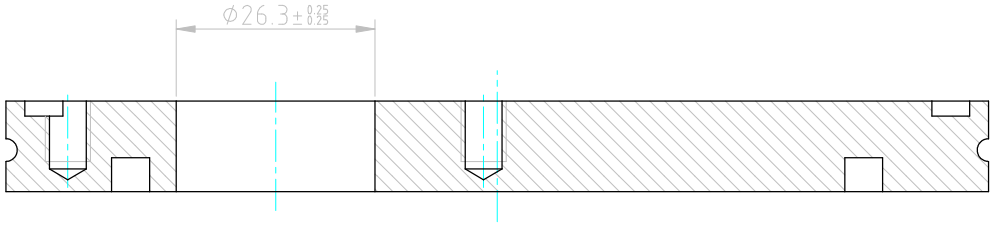
1	6wayCross100	Stainless Steel	1
Part #	Name	Material	Qty.
1:2	DIC Equipment		3/30
A4			04-09-2013
	Nuclear Fuels Project	Part drawing	S. Valance M. Raventos



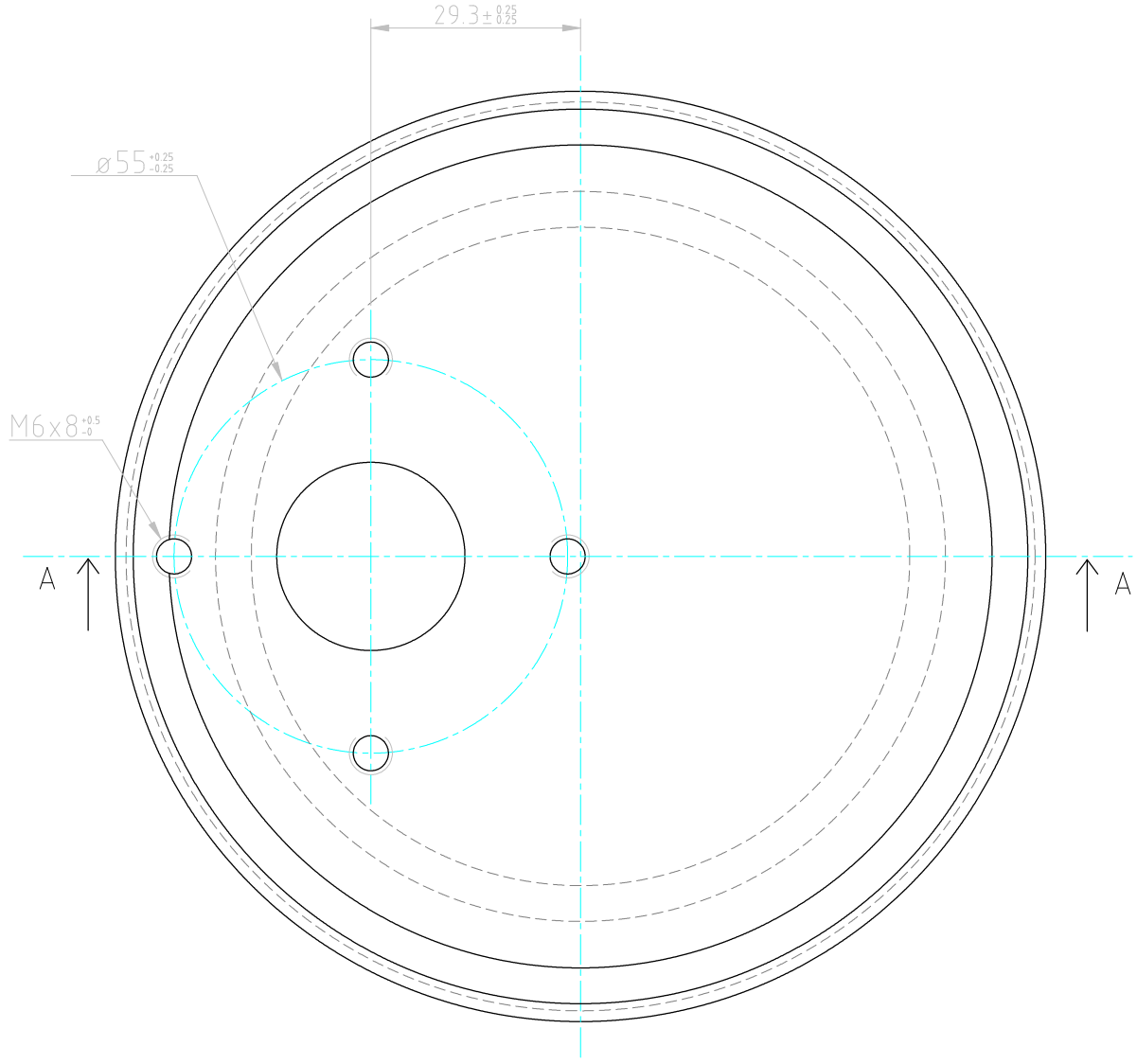
A-A



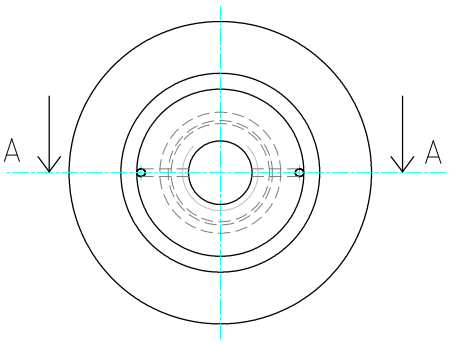
2	blankFlange__bot	Stainless Steel	1
Part #	Name	Material	Qty.
1:1	DIC Equipment		Page 4/30
A4			09-09-2013
	Nuclear Fuels Project	Part drawing	S. Valance M. Raventos

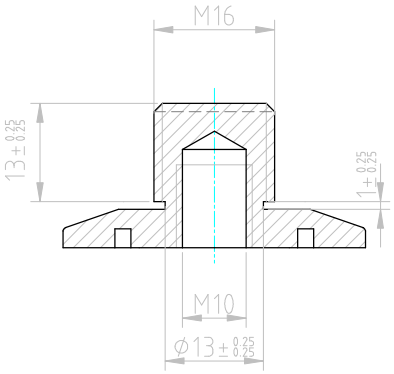


A-A



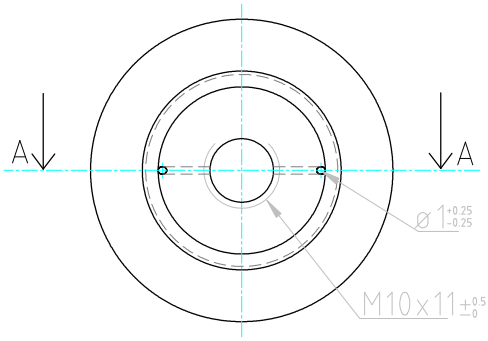
3	blankFlange__top	Stainless Steel	1
Part #	Name	Material	Qty.
1:1	DIC Equipment		Page 5/30
A4			10-09-2013
	Nuclear Fuels Project	Part drawing	S. Valance M. Raventos

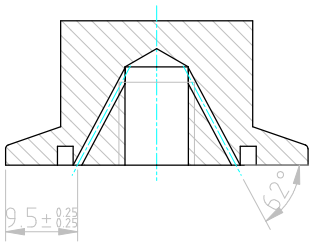




A-A

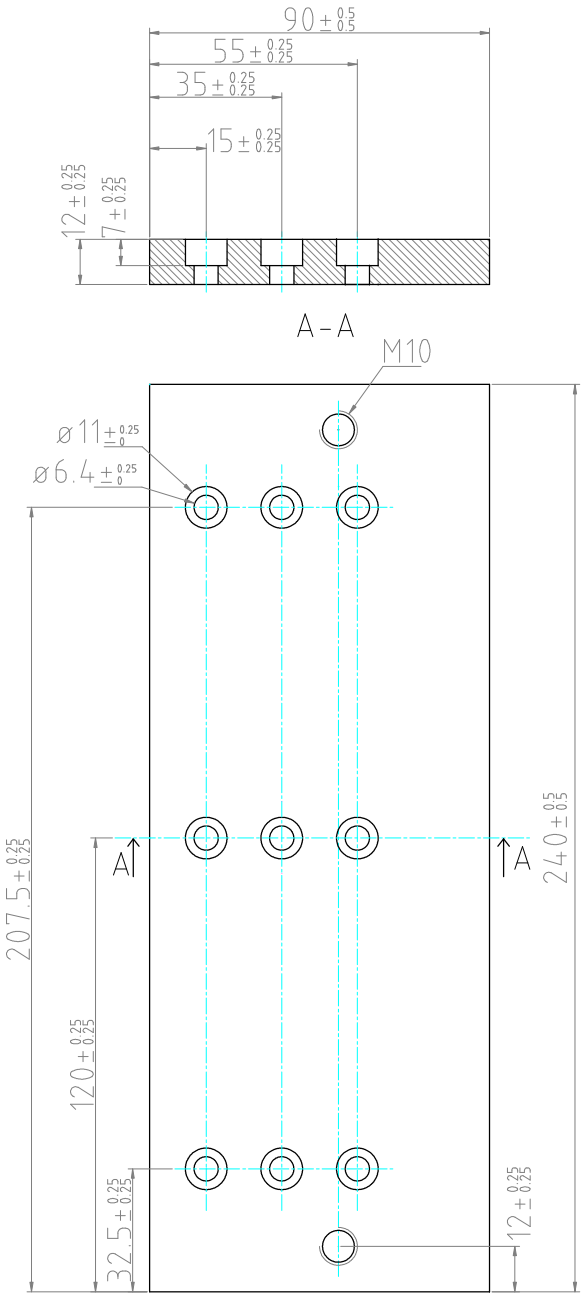
4	blankStub__bot	Stainless Steel	1
Part #	Name	Material	Qty.
1:1	DIC Equipment		Page 6/30
A4			09-09-2013
	Nuclear Fuels Project	Part drawing	S. Valance M. Raventos



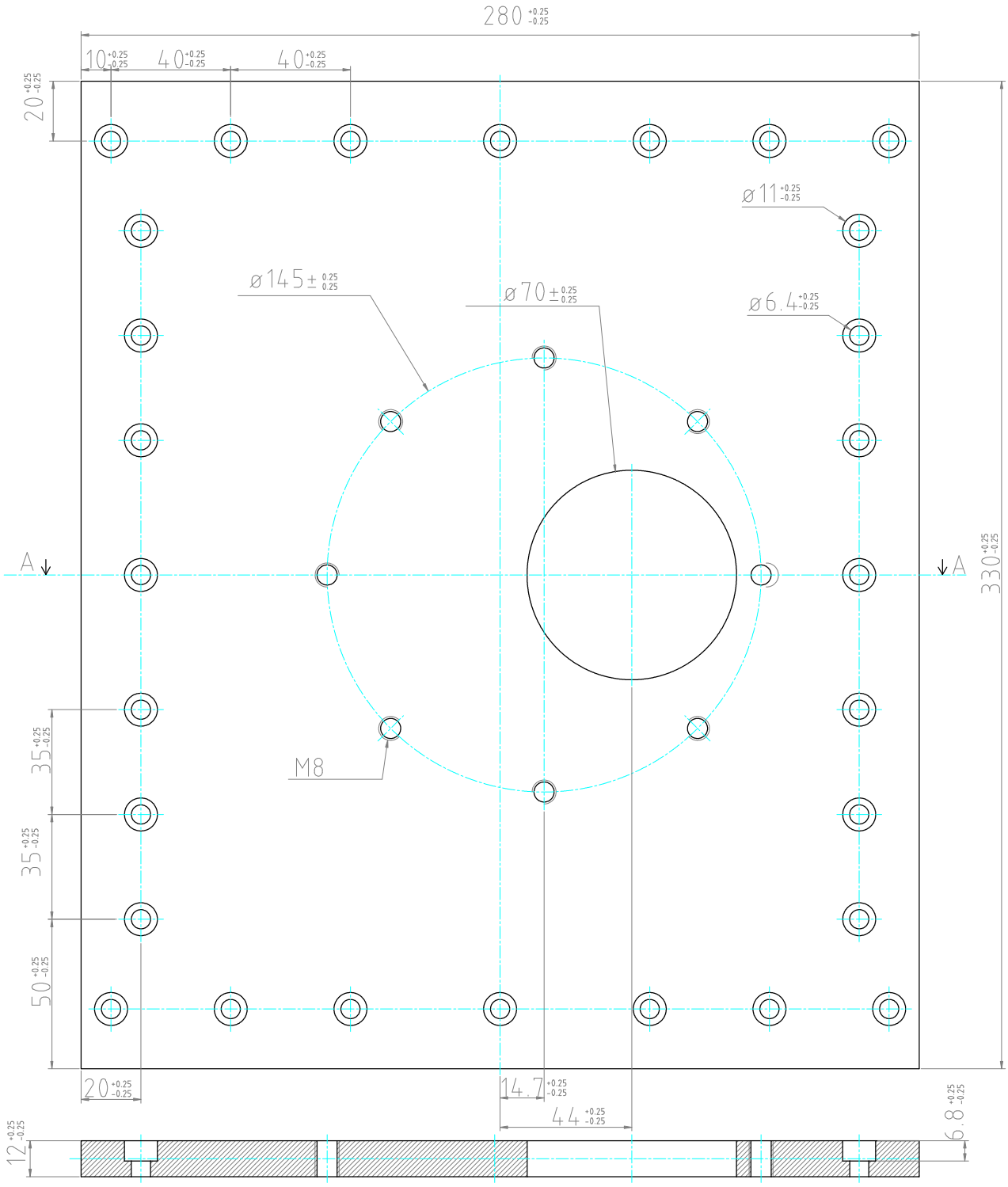


A-A

5	blankStub__top	Stainless Steel	1
Part #	Name	Material	Qty.
1:1	DIC Equipment		Page 7/30
A4			09-09-2013
	Nuclear Fuels Project	Part drawing	S. Valance M. Raventos

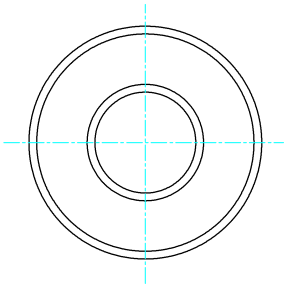


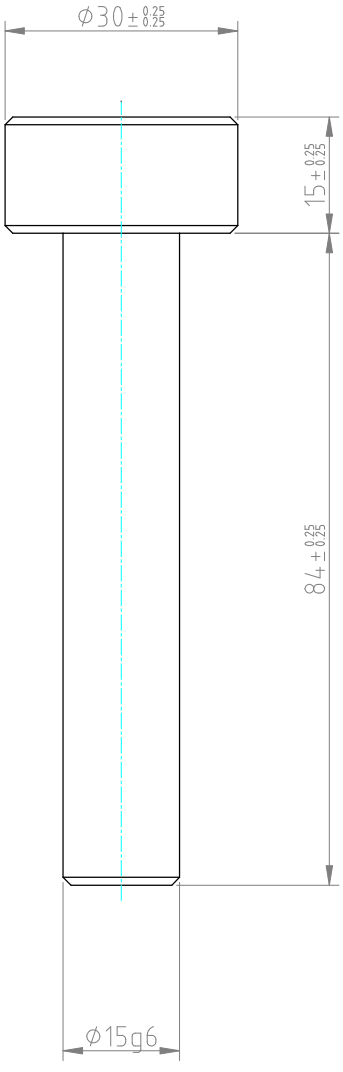
6	EP60Plate	Stainless Steel	1
Part #	Name	Material	Qty.
1:2	DIC Equipment		Page 8/30
A4			05-09-2013
	Nuclear Fuels Project	Part drawing	S. Valance M. Raventos



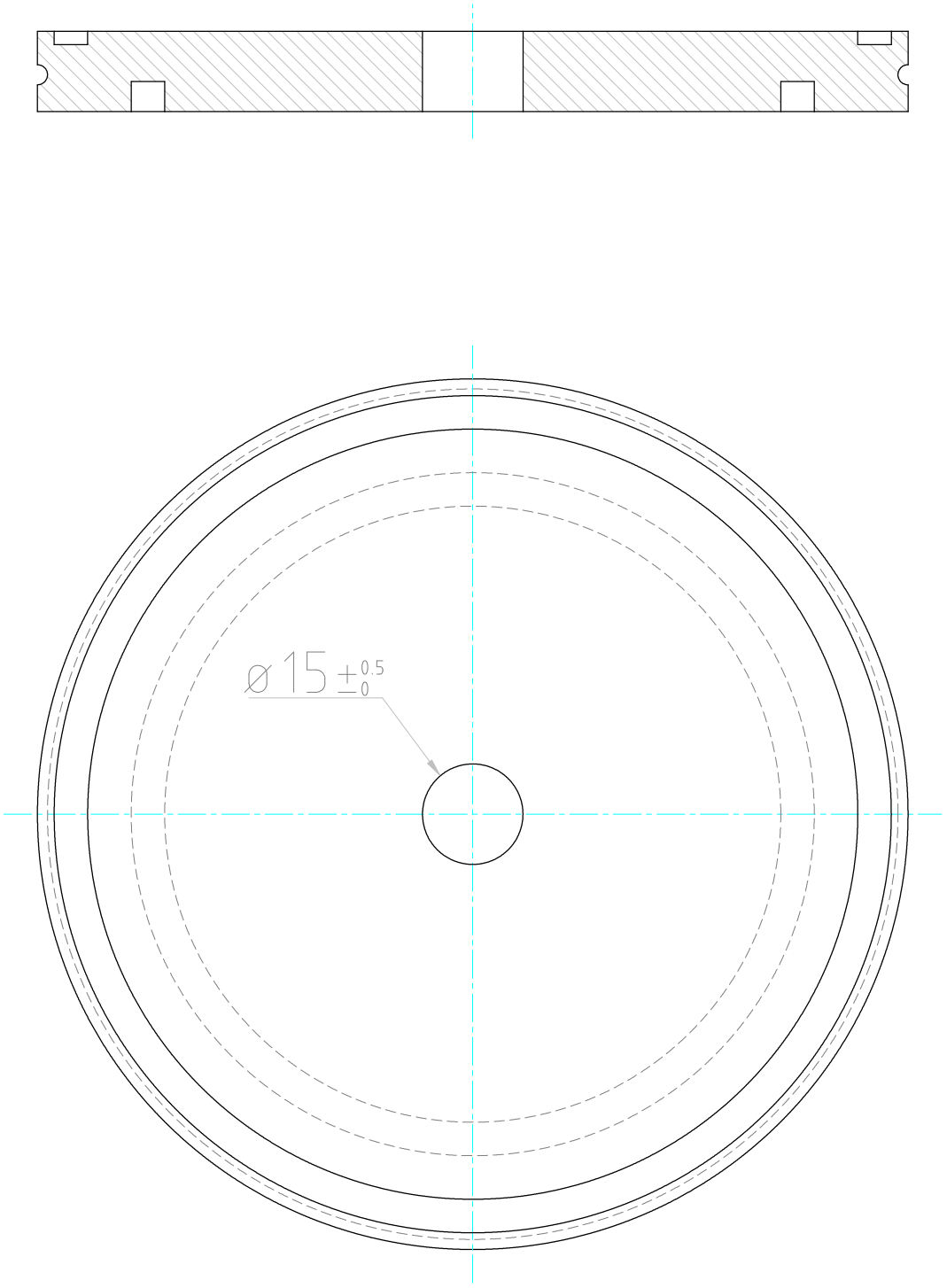
A-A

7	framePlate	Stainless Steel	1
Part #	Name	Material	Qty.
1:2	DIC Equipment		Page 9/30
A4			10-09-2013
	Nuclear Fuels Project	Part drawing	S. Valance M. Raventos

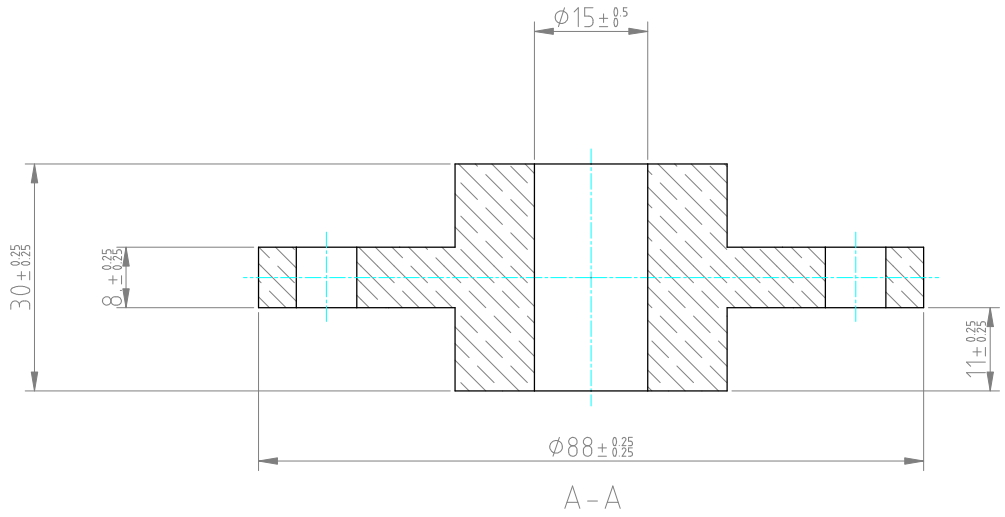


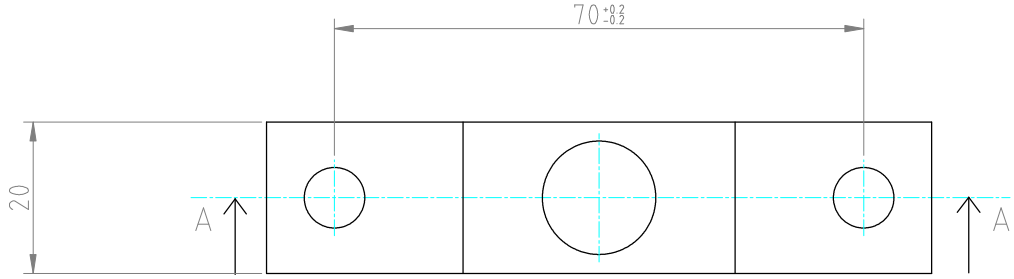


8	mountingAxe	Aluminium	1
Part #	Name	Material	Qty.
1:1	DIC Equipment		Page 10/30
A4			11-09-2013
	Nuclear Fuels Project	Part drawing	S. Valance M. Raventos

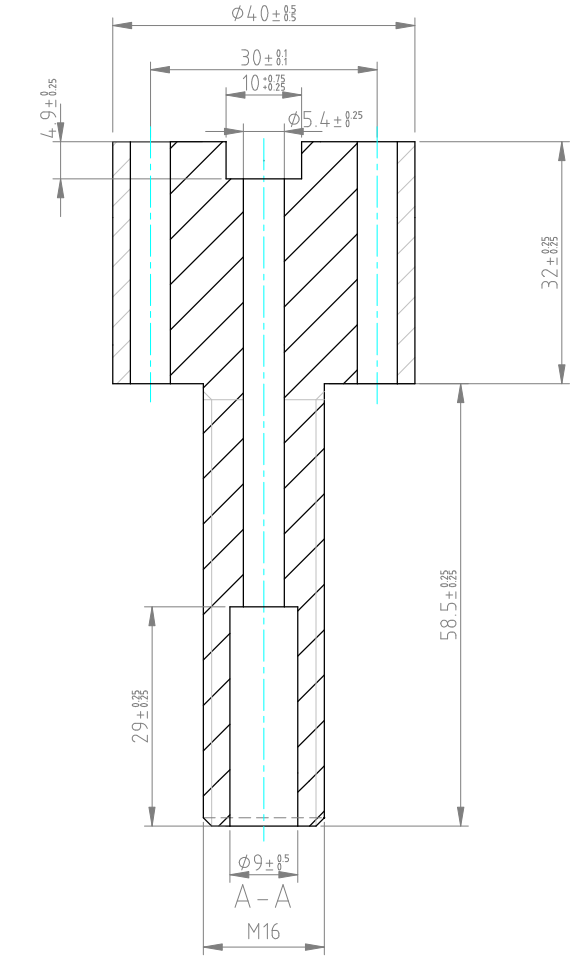


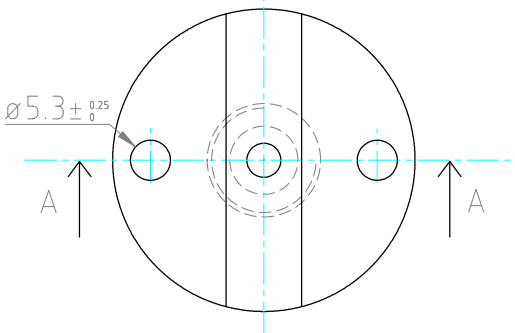
9	mountingFlange	Stainless Steel	1
Part #	Name	Material	Qty.
1:1	DIC Equipment		Page 11/30
A4			10-09-2013
	Nuclear Fuels Project	Part drawing	S. Valance M. Raventos



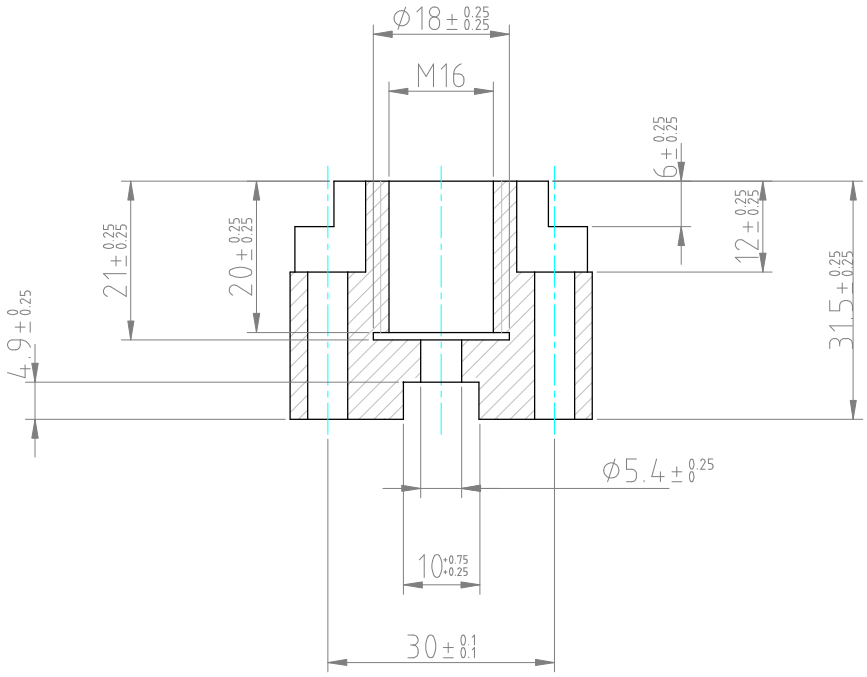


10	mountingMandrel	Aluminium	1
Part #	Name	Material	Qty.
1:1	DIC Equipment		Page 12/30
A4			12-09-2013
	Nuclear Fuels Project	Part drawing	S. Valance M. Raventos

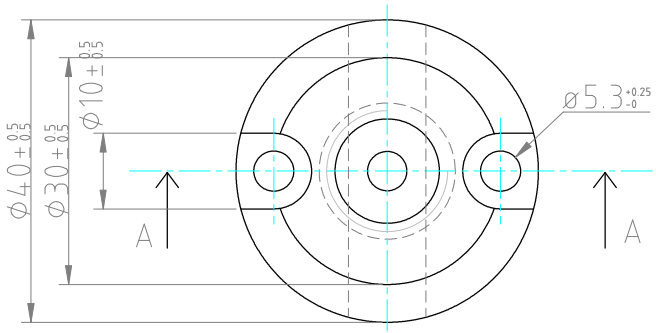




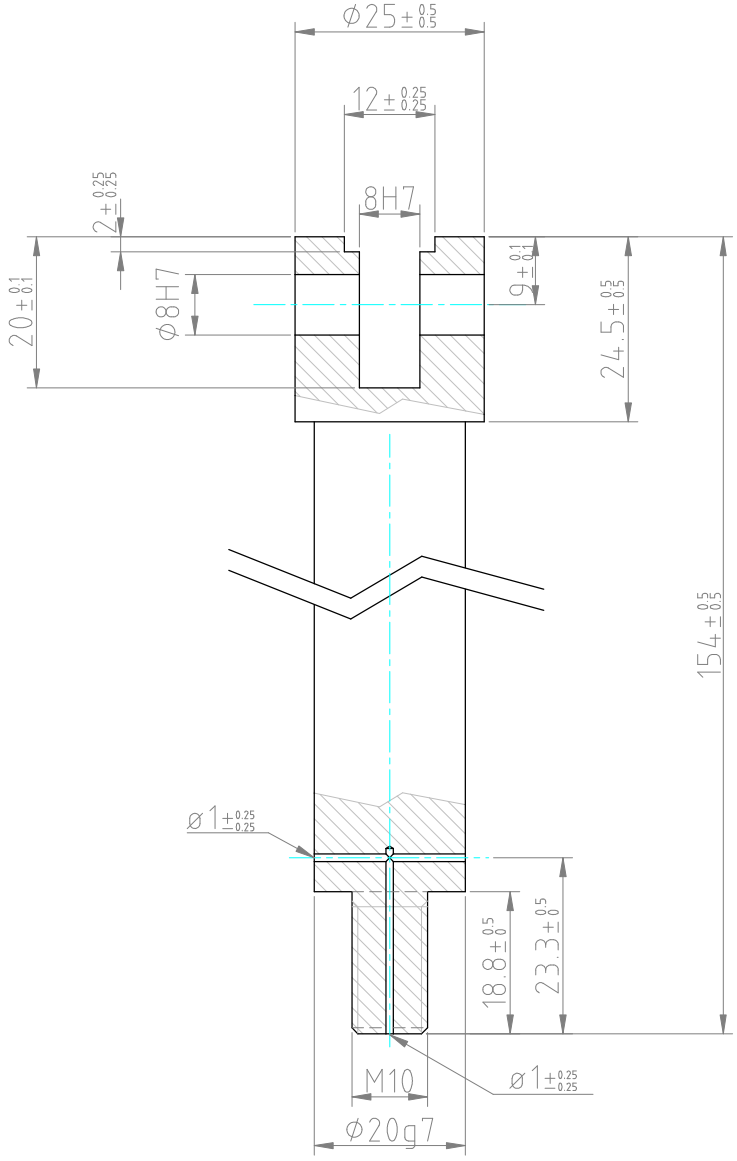
11	piezoAttach__bot	Stainless Steel	1
Part #	Name	Material	Qty.
1:1	DIC Equipment		Page 13/30
A4			04-09-2013
	Nuclear Fuels Project	Part drawing	S. Valance M. Raventos



A-A



12	piezoAttach__top	Stainless Steel	1
Part #	Name	Material	Qty.
1:1	DIC Equipment		Page 14/30
A4			04-09-2013
	Nuclear Fuels Project	Part drawing	S. Valance M. Raventos



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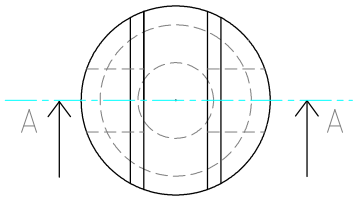
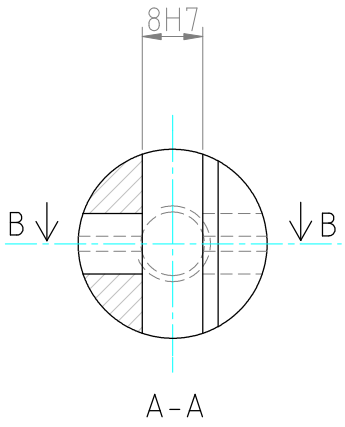
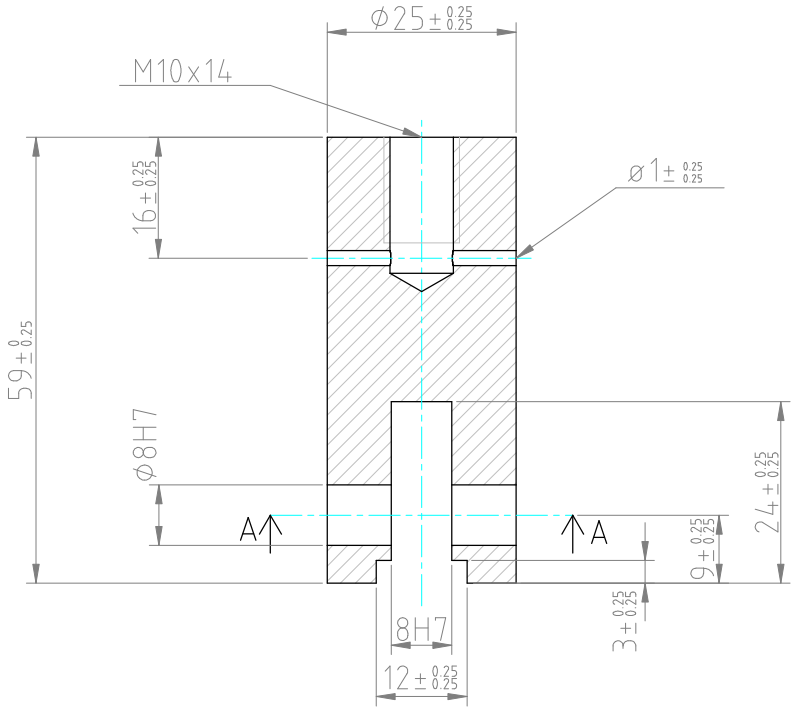


13	pullingRod__bot	Stainless Steel	1
Part #	Name	Material	Qty.
1:1	DIC Equipment		Page 15/30
A4			06-09-2013
	Nuclear Fuels Project	Part drawing	S. Valance M. Raventos

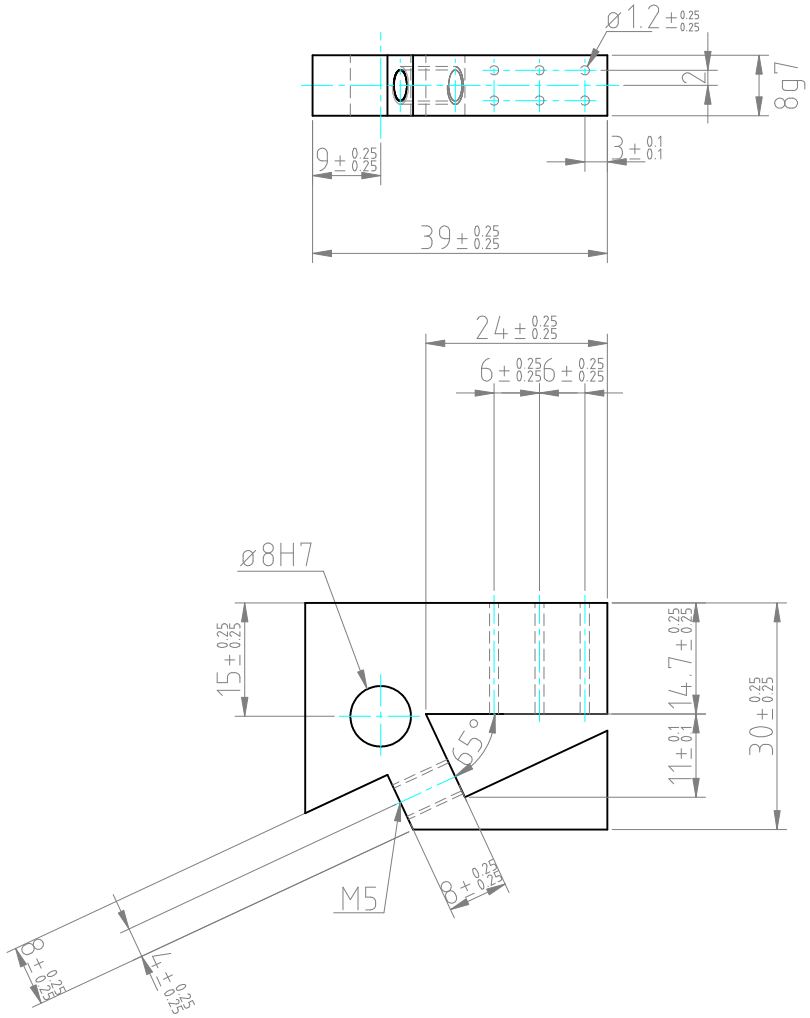


A-A

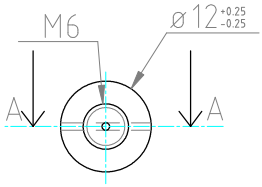


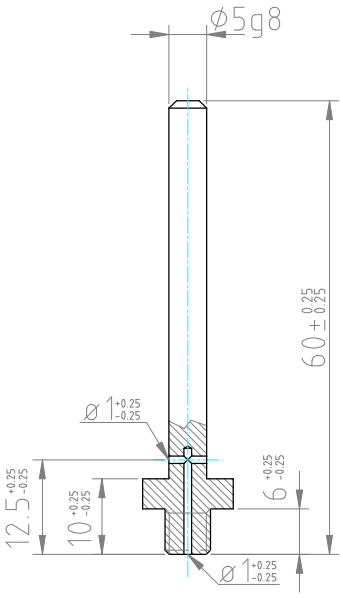
B-B

14	pullingRod__top	Stainless Steel	1
Part #	Name	Material	Qty.
1:1	DIC Equipment		Page 16/30
A4			11-09-2013
	Nuclear Fuels Project	Part drawing	S. Valance M. Raventos



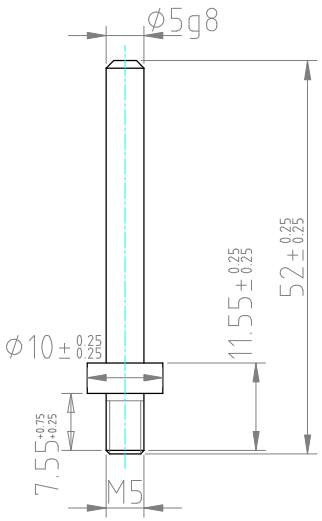
15	sampleHolder	Stainless Steel	2
Part #	Name	Material	Qty.
1:1	DIC Equipment		Page 17/30
A4			12-09-2013
	Nuclear Fuels Project	Part drawing	S. Valance M. Raventos



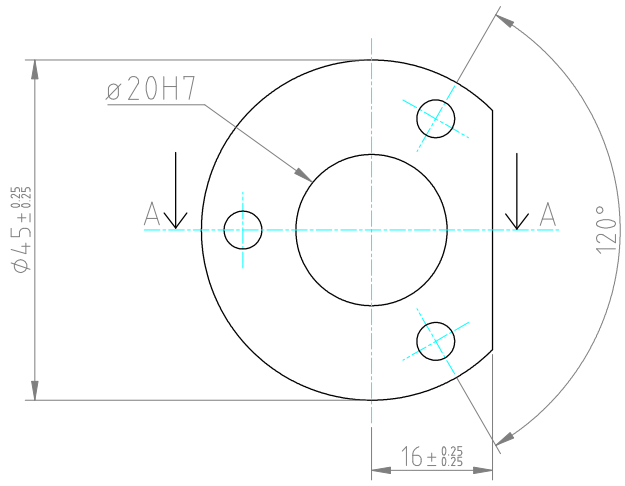


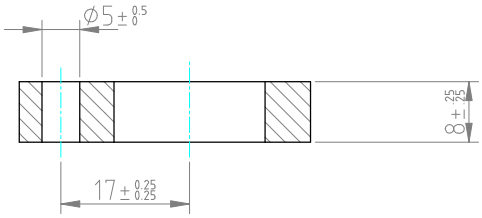
A-A

16	springRod_in	Stainless Steel	3
Part #	Name	Material	Qty.
1:1	DIC Equipment		Page 18/30
A4			04-09-2013
	Nuclear Fuels Project	Part drawing	S. Valance M. Raventos



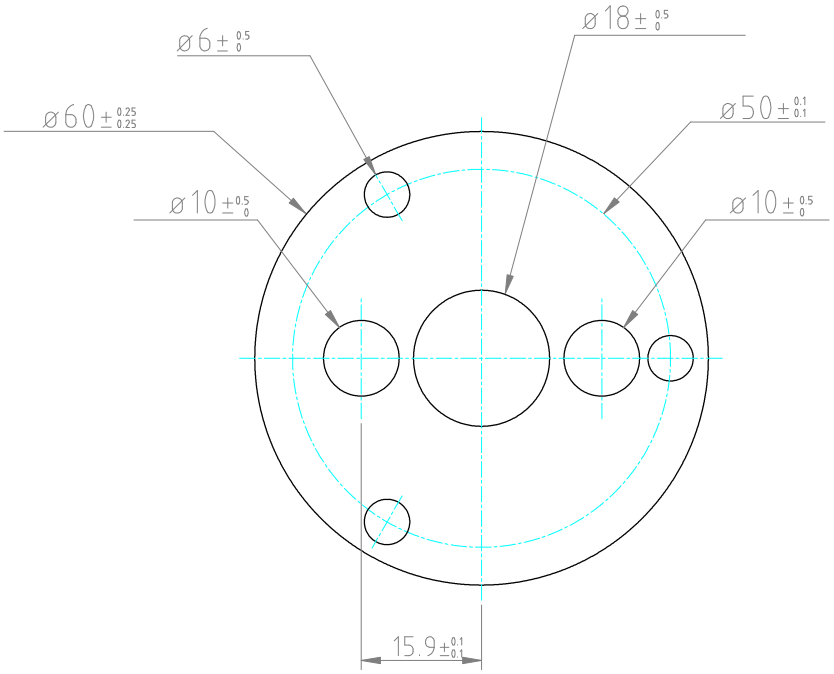
17	springRod__out	Stainless Steel	3
Part #	Name	Material	Qty.
1:1	DIC Equipment		Page 19/30
A4			06-09-2013
	Nuclear Fuels Project	Part drawing	S. Valance M. Raventos





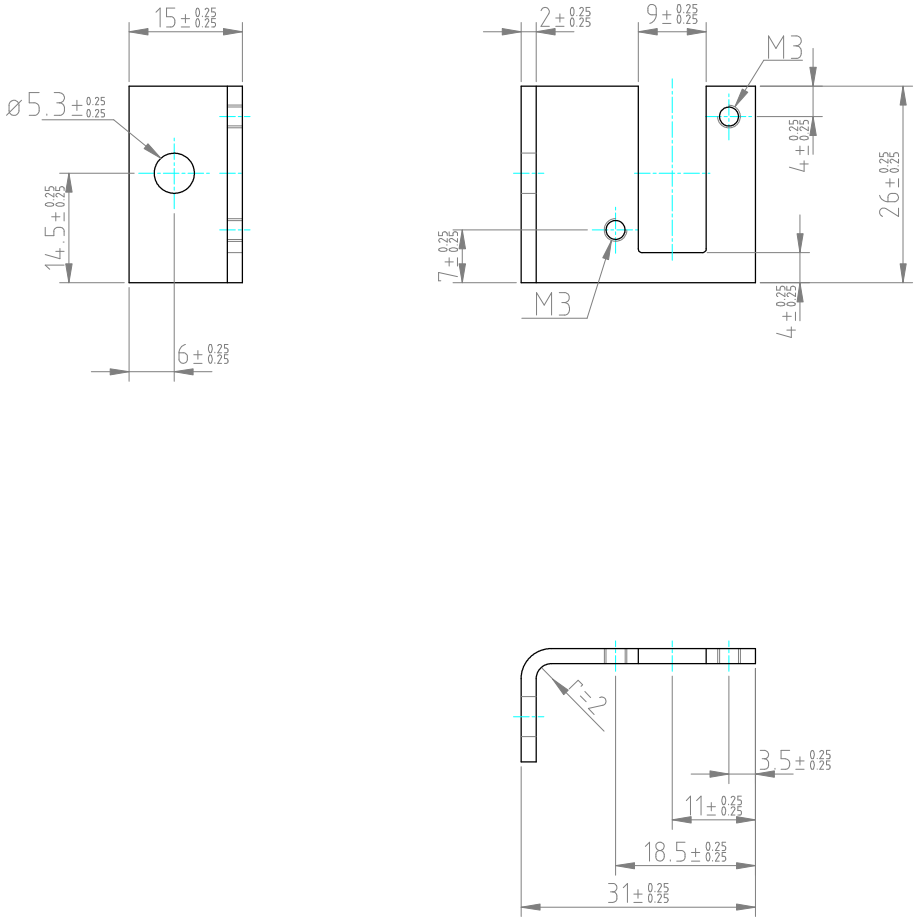
A-A

18	springWasher__in	Stainless Steel	1
Part #	Name	Material	Qty.
1:1	DIC Equipment		Page 20/30
A4			10-09-2013
	Nuclear Fuels Project	Part drawing	S. Valance M. Raventos

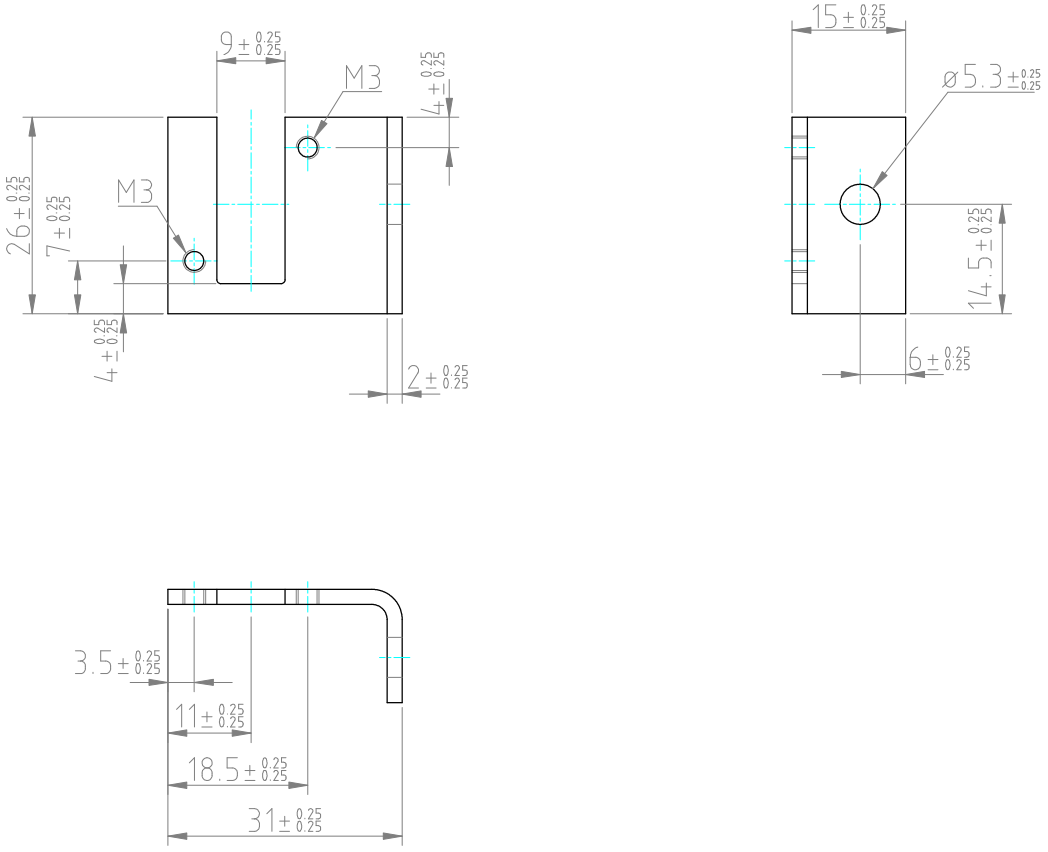


Thickness: 2mm

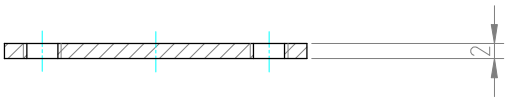
19	springWasher__out	Aluminium	1
Part #	Name	Material	Qty.
1:1	DIC Equipment		Page 21/30
A4			10-09-2013
	Nuclear Fuels Project	Part drawing	S. Valance M. Raventos



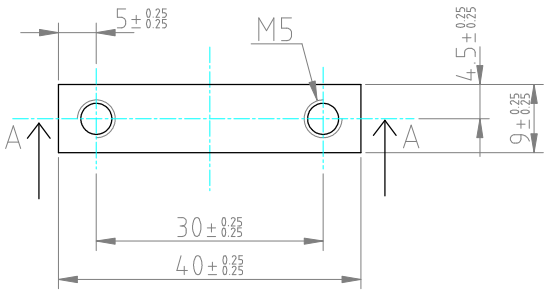
20	supportIR__botLtopR	Aluminium	3
Part #	Name	Material	Qty.
1:1	DIC Equipment		Page 22/30
A4			11-09-2013
	Nuclear Fuels Project	Part drawing	S. Valance M. Raventos



21	supportIR__botRtopL	Aluminium	3
Part #	Name	Material	Qty.
1:1	DIC Equipment		Page 23/30
A4			11-09-2013
	Nuclear Fuels Project	Part drawing	S. Valance M. Raventos

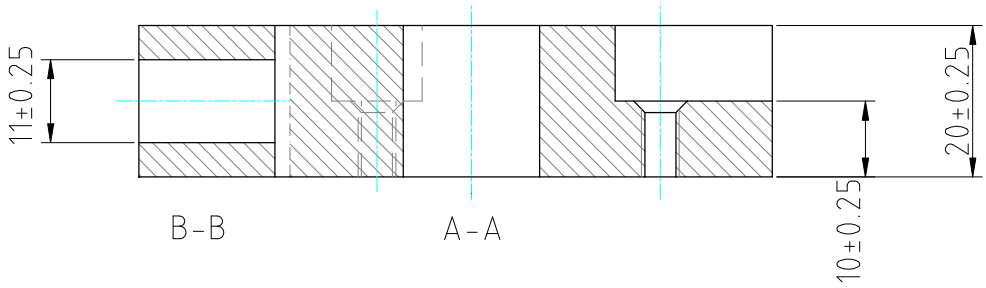


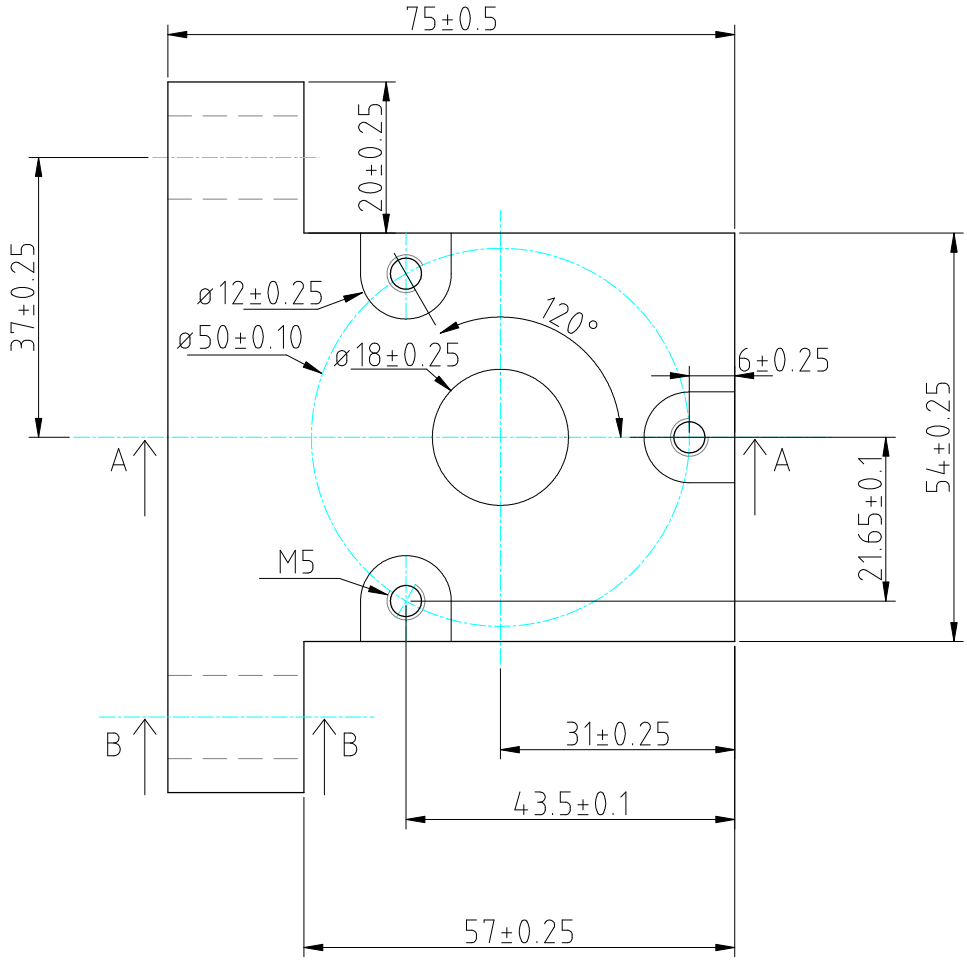
A-A



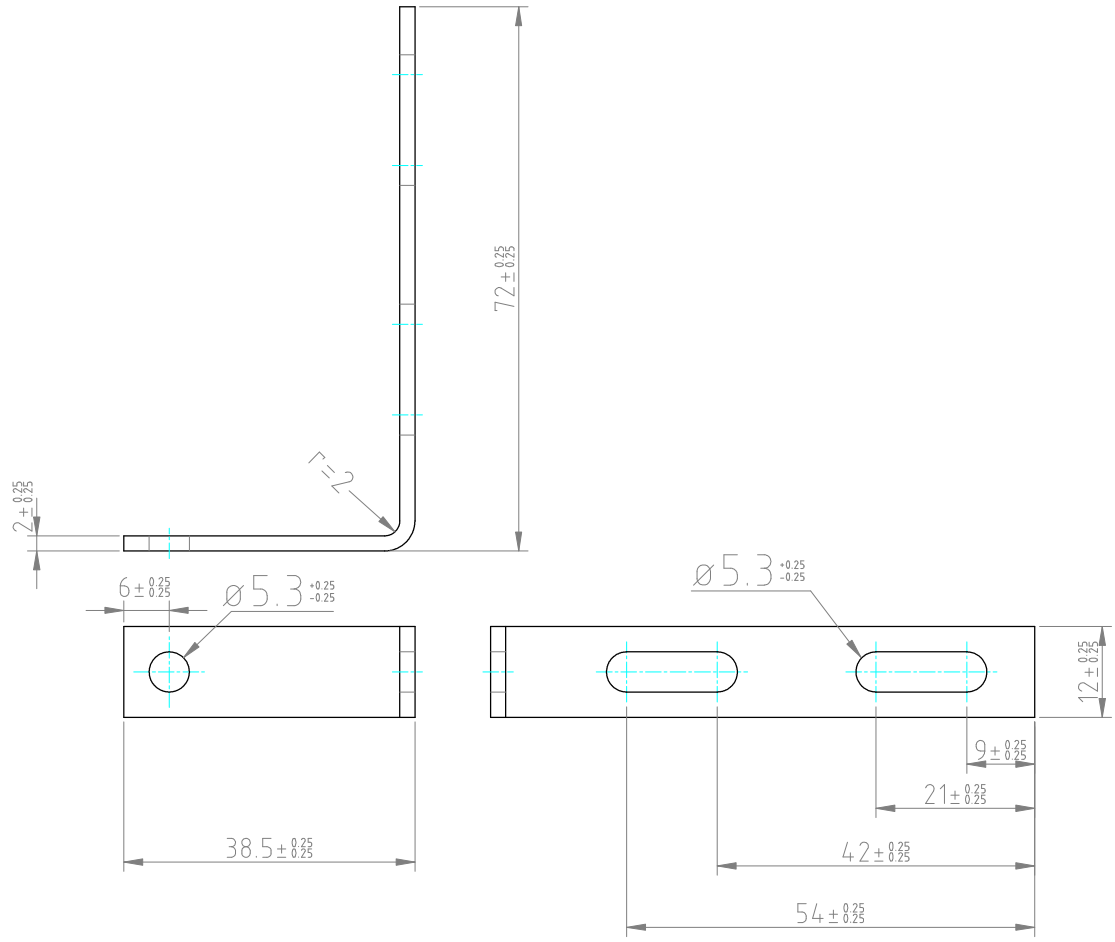
Thickness=2mm

22	piezoJumper	Stainless Steel	2
Part #	Name	Material	Qty.
1:1	DIC Equipment		24/30
A4			27-09-2013
	Nuclear Fuels Project	Part drawing	S. Valance M. Raventos

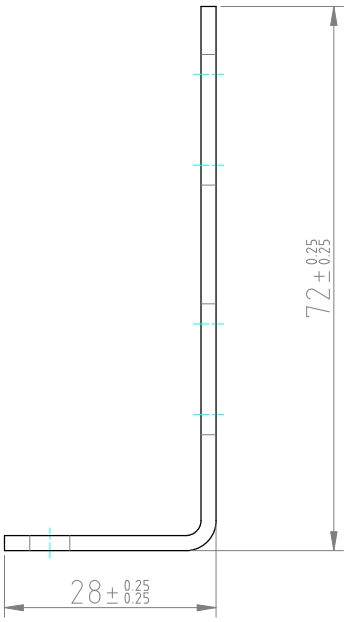


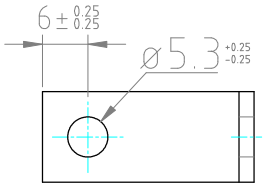


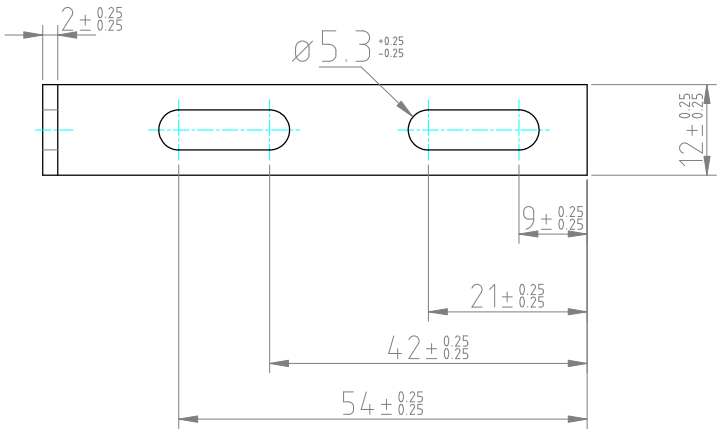
23	piezoPlate__v3.dxf	Stainless Steel	1
Part #	Name	Material	Qty.
1:1	DIC Equipment		25/30
A4			10-01-2014
	Nuclear Fuels Project	Part drawing	S. Valance M. Raventos



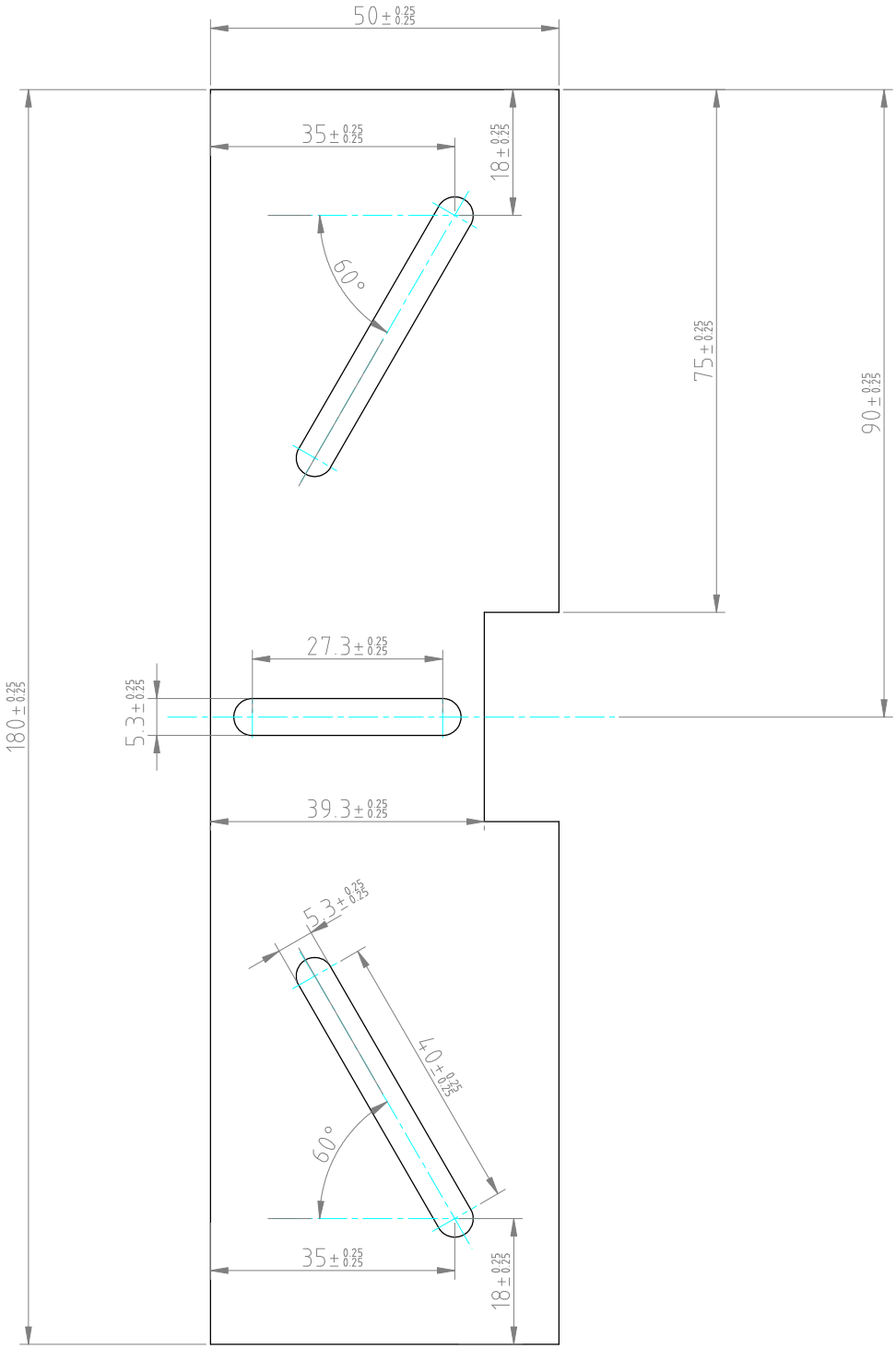
24	equerreIR__side	Aluminium	2
Part #	Name	Material	Qty.
1:1	DIC Equipment		Page 26/30
A4			10-09-2013
	Nuclear Fuels Project	Part drawing	S. Valance M. Raventos





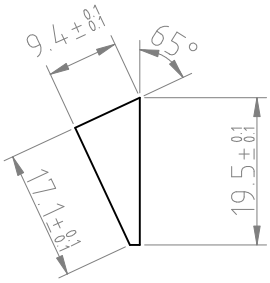


25	equerreIR__back	Aluminium	1
Part #	Name	Material	Qty.
1:1	DIC Equipment		Page 27/30
A4			10-09-2013
	Nuclear Fuels Project	Part drawing	S. Valance M. Raventos



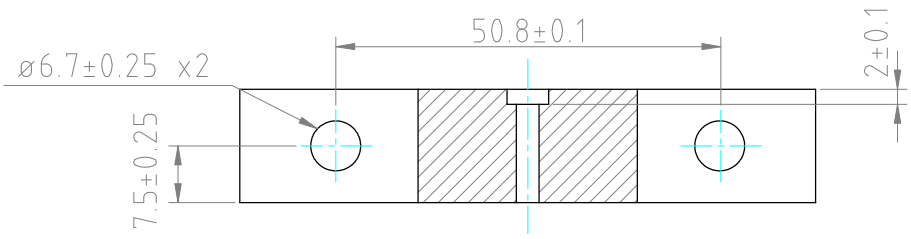
Thickness: 2mm

26	centralDeck	Aluminium	1
Part #	Name	Material	Qty.
1:1	DIC Equipment		Page 28/30
A4			09-09-2013
	Nuclear Fuels Project	Part drawing	S. Valance M. Raventos

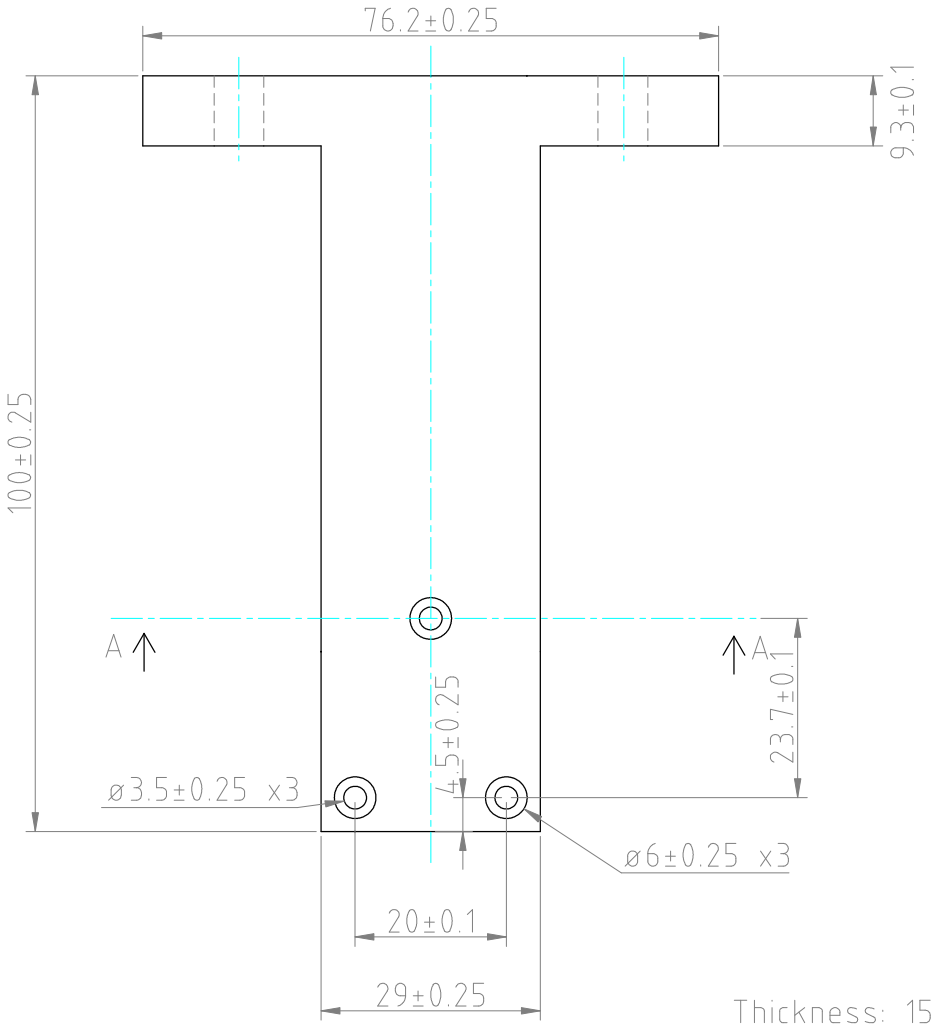


Thickness=8mm

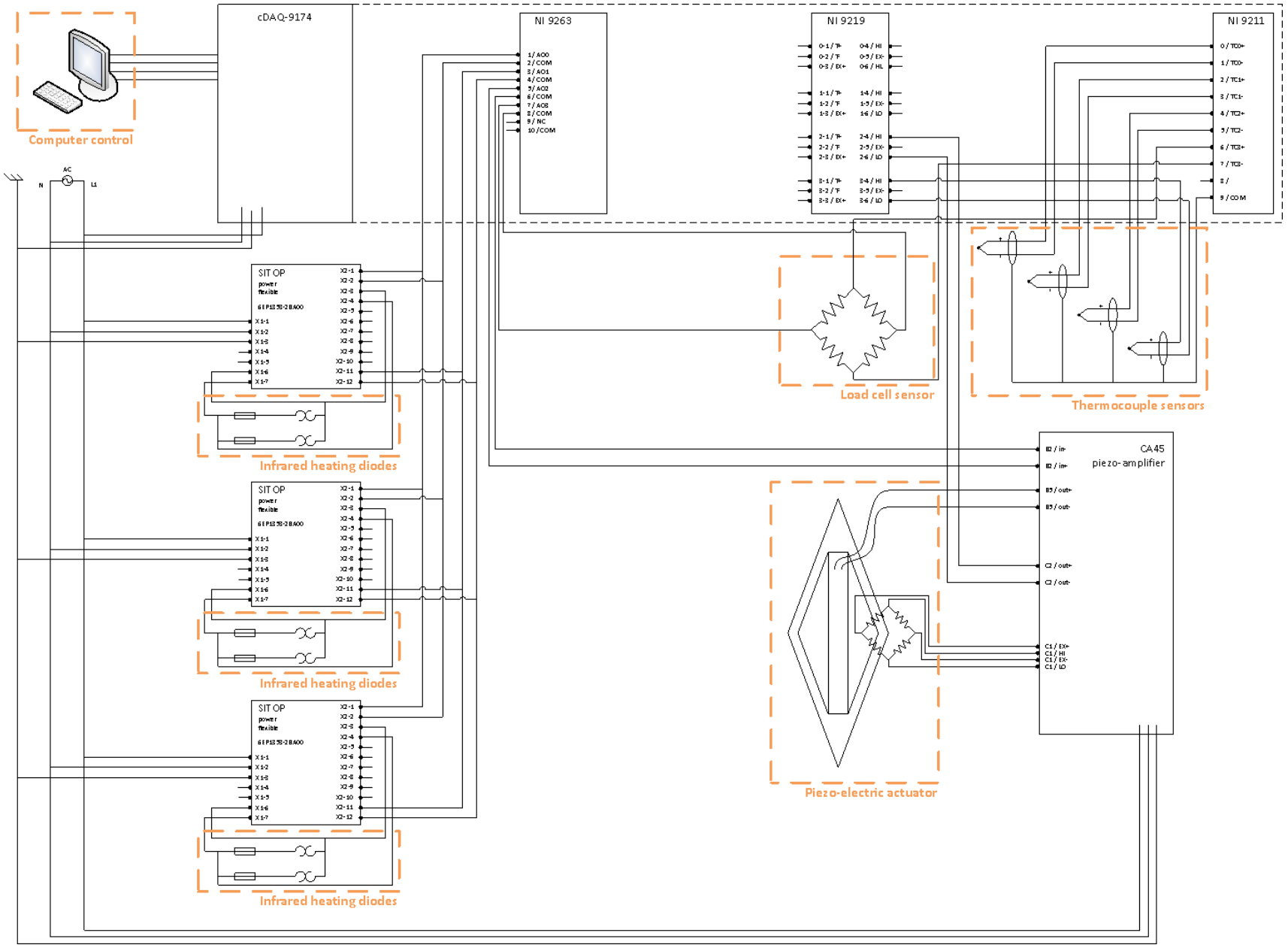
27	sampleHolder__blocker	Stainless Steel	2
Part #	Name	Material	Qty.
1:1	DIC Equipment		Page 29/30
A4			26-09-2013
	Nuclear Fuels Project	Part drawing	S. Valance M. Raventos



A-A



Thickness: 15mm

28	CameraSupport	Aluminium	1
Part #	Name	Material	Qty.
1:1	DIC Equipment		30/30
A4			28-01-2014
	Nuclear Fuels Project	Part drawing	S. Valance M. Raventos

ANNEX C: ELECTRIC SCHEME